F. BOZORGNIA

PALEOZOIC FORAMINIFERAL BIOSTRATIGRAPHY OF CENTRAL AND EAST ALBORZ MOUNTAINS, IRAN

NATIONAL IRANIAN OIL COMPANY

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ABSTRACT

The microfossils (*Foraminiferida*, except larger *Fusulinda*, and certain *Algae*) of about 9000 samples from Middle Cambrian through Upper Permian (Julfian) of the central and east Alborz Mountains, were taxonomically and biostratigraphically investigated. The study is essentially centered on the Lower Carboniferous where 8 biozones are distinguished and correlated with those of the Franco-Belgian basin, the Russian platform, the Ural and Kazakhstan regions of the USSR and of North America. The paper contains the descriptions of 164 species of foraminifera and Algae. Two families *Dagmaritidae* and *Geinitzindae*, one endothyroid genus and 29 species of foraminifera and Algae are new. Within the eastern Alborz Mountains the presence of a thick succession of Silurian and Lower to Middle Dovenian sediments has been established for the first time.

I. INTRODUCTION

The first information on paleozoic smaller foraminifera of Iran may be found in the publication by Moeller (1880) who studied the samples collected by Tietze from outcrops in the vicinity of Esfahan and by Goebel in Gorgan and Shahrud regions. Moeller dated these rocks as Carboniferous and also described the new foraminiferal species *Stacheia grewinki*. Much later, Douglas (1951) identified and figured some small Carboniferous and Permian foraminifera from

* National Iranian Oil Company, P.O. Box 1516, Tehran-Iran

South Iran and Iranian Baluchistan. Still later, Dellenbach (1969) collected samples from the Lower Carboniferous of the Mobarakabad section, NE of Abe-Ali, which were examined by Lys whose results were published in Dellenbach's thesis. No comprehensive paper on the Paleozoic smaller foraminifera of Iran has been published. However a limited amount of data on Paleozoic forms, though rather rudimentary, is available in the reports of the Geological Survey of Iran.

The purpose of this study is to present a taxonomic analysis and a biostratigraphic evaluation of the Paleozoic microfaunas of the Alborz Mountains with the ultimate aim to establish a micro-biostratigraphic zonation of the Paleozoic strata.

To determine the stratigraphic position of these sediments and to define the marker beds within each rock-unit, the author and his colleagues of the National Iranian Oil Company have measured the following 18 geological sections with an average sampling interval of about one meter.

Abnak (F. Bozorgnia and I. Yassini)
Amol (F. Bozorgnia and I. Yassini)
Aruh (I. Yassini and A. Mojtahedi)
Chaboksar (F. Bozorgnia and I. Yassini)
Chandaran (I. Yassini and A. Mojtahedi)
Dozdehband (F. Bozorgnia and I. Yassini)
Elika (F. Bozorgnia and I. Yassini)
Gaduk (I. Yassini and A. Mojtahedi)
Hassanakdar (F. Bozorgnia and I. Yassini)
Kelariz (H. Bozorgnia)
Khoshyeilagh (H. Bozorgnia, A. Bayat and A. Memar)
Mobarakabad (F. Bozorgnia, I. Yassini and A. Mojtahedi)
Nessen (I. Yassini)
Peyghambaran (I. Yassini and A. Mojtahedi)
Robate-Gharabil (A. Afshar-Harb)
Ruteh (I. Yassini)
Shahmirzad (I. Yassini and A. Mojtahedi)
Valiabad (A. Mojtahedi)

The locations of the listed sections are indicated on the inset map in the correlation chart of the Paleozoic sections of the Alborz Mountains. Due to the hard nature of the sampled rocks, the paleontological studies were carried out only on thin sections.

II. ACKNOWLEDGMENTS

I am greatly indebted to the managent of the National Iranian Oil Company for the permission to publish this paper.

I am thanking all my colleagues who helped me in the field and in the laboratory particularly Mr. I. Yassini, Mr. A. Mojtahedi and Mr. Kh. Kordbacheh.

I am especially indebted to Mr. M. Lys University of Paris, Mr. R. Conil, University of Louvain and Mr. M. Vanguestaine, University of Liège for helping me in the determination of the microfaunas and microfloras.

It is a pleasure to thank Mr. E. Kavari, Mr. I. Salehi and Mr. Y. Paran for reading this manuscript.

I am greatful to Mr. P. Broennimann, University of Geneva for making constructive criticismes, and giving valuable suggestions. His generous helps enabled me to go through the last stages of this paper.

III. STRATIGRAPHY

In this chapter, the stratigraphic succession will be discussed in the following order: Ordovician, Silurian, Devonian, Carboniferous and Permian. For information regarding the Pre-Ordovician sediments, the reader is referred to Stöcklin et al. (1964).

Ordovician

Lashkarak formation

In 1962, Gansser and Huber recognized a sedimentary sequence comprising the rocks overlying the Lower Cambrian Lalun formation and underlying the Late Paleozoic limestones of the Mobarak formation and called it Lashkarak formation. Since the lithologic description given by these authors was incomplete, Glaus (1965, p. 36) redescribed the Lashkarhak formation from top to bottom as follows:

"7) 30 m gelblich-braeunlich, rostig anwitternde Sandsteine. Gegen unten Einschaltung von grauen, siltigen Schiefern. Uebergang in

6) 25 m graue bis schwaerzliche, siltig-tonige Schiefer. Im untersten Teil wechsellagernd mit duennen Baenken von geblich-grauen, fossilleeren Kalken. Uebergang in

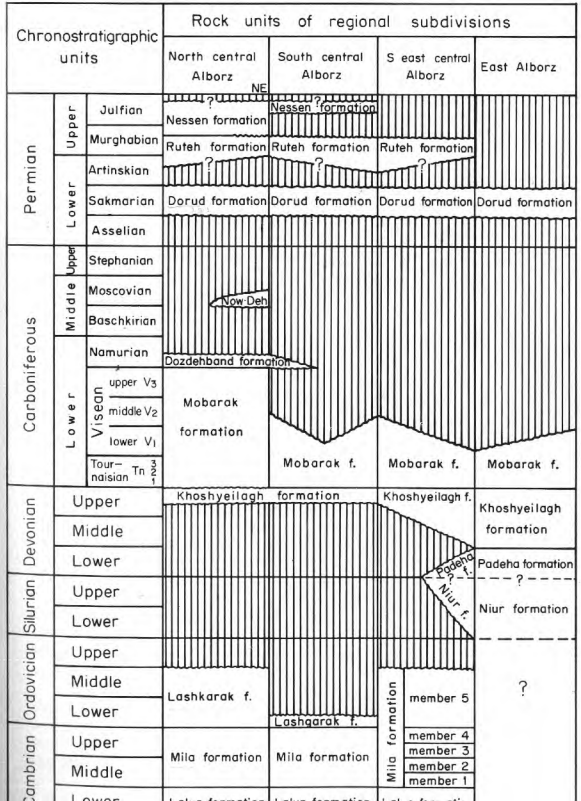
5) 8 m rote, kalkige, leicht knollige Mergel. Die Mergel enthalten zuoberst noch duenne Kalkbaenke. Trilobiten, Cystoitoiden.

4) 17 m rote, mergelige Kalke; die schieferigen, leicht knolligen Kalke fuehren Lagen von gelben duennplattigen Kalken. Die Schieferkalke schlissen unten mit einer 1-2 m maechtigen Bank von kompakten, roten Kalken ab, die spaetig und oertlich schwach mergelig sind. Cystoiden, Brachiopoden.

3) 10 m feinsandige bis siltige, roetliche gegen oben mehr gruenliche bis gelbliche Schiefer. Duenne Sandsteinlagen.

2) 25 m eher duennbankige, roetlich-weisse Quarzarenite. Im unteren Teil dickbankige weisse, zuunterst rote, duennplattige Quarzarenite.

1) 60 m gelbe, im Bruch rote bis gelblich-graue Dolomite, feinkoernig, gut gebankt. Haufig mit dunkeln Cherts."



Rocks similar to those of unit 3 of the Lashkarak formation are exposed in the section of Hassanakdar on the road from Karaj to Gachessar. Here, fossiliferous dolomitic limestones of the Middle to Upper Cambrian Mila formation are overlain by about 25 m of green and red, silty shales with some intercalations of thin bedded sandstones. A sample from the lower part of the silty shale was examined for playnomorphs by Mr. M. Vanguestaine, Laboratoire de Paléontologie Végétal de l'Université de Liège, Belgium, in which he recognized:

Priscogalea cf. *striatula*, *Acanthodiacrodium* sp., *Acanthodiacrodium convexum* and the representatives of the genera *Leiosphaeridia* and *Goniosphaeridium*.

The following description is quoted from his letter dated 16 December 1971:

> "*Periscogalea striatula* est une espèce de l'Arenig des schistes de Klabava de Bohême. Elle est aussi connue dans le Tremadocian de Belgique. *Acanthodiacrodium convexum* est décrit dans la couche a *Dictyonema* de la région de Leningrad et dans le Tremadocian inférieur de Belgique. Par ailleurs, les genres *Acanthodiacrodium* et *Priscogalea* sont surtout abodants dans le Tremadocien. Ces données, ainsi que l'absence d'espèces typiques du Cambrien ou de l'Arenig et la grande similitude entre l'assemblage du Tremadocien de Belgique et celui de l'échantillon d'Hassanakdar, suggèrent pour ce dernier un âge de Tremadocien."

On the basis of the above age detemination and the lithology it is concluded that at least the lowermost unit of the Lashkarak formation should be ragrded as Middle to Upper Cambrian and placed into the Mila formation. Unit 2 is here considered to represent the base of the Lashkarak formation of Ordovician age. The total thickness of the Lashkarak formation in the type section does not exceed 140 m.

In the section of Mobarakabad NE of Abe-Ali, underlying the Upper Devonian Famennian, fossiliferous greyish shales, limestones and marls, occurs a thick sequence of red and yellowish-white sandstones and quartzitic sandstones. These rocks overlie the dolomites of the Mila formation. No fossils have been found in these beds but

lithologically they appear to be the equivalent of unit 2 of the Lashkarak formation as described by Claus (1964).

SILURIAN-LOWER DEVONIAN

Gushkamar group

Until recently, Silurian and Lower Devonian sediments were completely unknown in North and North-Central Iran. Their presence was first established by Fluegel and Ruttner (1962) in the Ozbak-Kuh Mountains in the north-eastern part of central Iran. Later, Ruttner, Nabavi and Alavi Naini (unpublished MS Geol. Survey of Iran) proposed the name of Gushkamar group for these sediments. This name was accepted by Stöklin (1971, p. 110). It consists from bottom to top of two formations, namely the Niur formation and the Padeha formation. An equivalent of the Gushkamar group has been described in the Shirgesht area N of Tabas and compared with the type section by Ruttner, Nabavi and Hajian (1968).

SILURIAN

Niur formation

The type section of the Niur formation is located in the central part of the Ozbak-Kuh Mountains. This formation is 446 m thick and consists of dolomites, fossiliferous limestones and shales. In the section situated 10 km N of Shirgesht, the Niur formation is reported to be composed mainly of sandstones, quartzites and shales with some intercalations of fossiliferous limestones (Ruttner, Nabavi and Hajian, 1968) .

In 1970, Alavi Naini and Flandrin, introduced in a correlation chart of the Paleozoic-Mesozoic formations of the eastern part of the Semnan area, a sequence of about 1200 m of limestones, sandstones, shales and dolmites as the Boz-Kuh series. The age of the Boz-Kuh series was given by these authors as Silurian to Lower Devonian. Alavi Naini in his thesis (in press) subdivided the Boz-Kph series in

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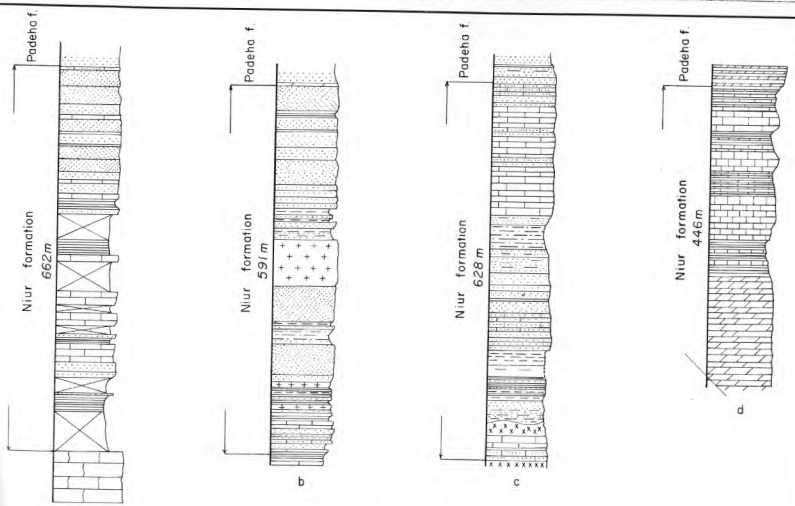


Silurian sections , Scale 1:5000

a, Robat-e-Gharabil (measured by: A. Afshar-Harb)

b, Boz-Kuh (measured by: M. Alavi – Naini)

c, Shirgesht (measured by: A. Ruttner, M.H. Nabavi & J. Hajian)

the following 3 formations. They are in ascending order: Niur formation, Padeha formation and Sibzar formation.

The lower 591 m of this series are equivalent to the Silurian Niur formation. It consists mostly of sandstones and subordinate beds of fossiliferous limestones and shales. A 75 m thick layer of trachy-andesite occurs in the middle part of the Niur formation.

A similar succession has recently been found by A. Afshar-Harb in Robate-Gharabil area, E of Gonbade-Kabus. The coordinates of the base of the section are: 56° 18' E and 37° 22' N. In this section the Niur formation is composed of an alternation of fossiliferous limestones and shales in the lower part and red sandstones in the upper part. The fossils collected from this succession consists of corals, brachiopods and *Bryozoa*. They are currently under study. The corals have been studied by Mr. M. J. Lafust, France, and according to oral information received from Abbé A. De Lapparent, the age of these beds is Upper Silurian.

Despite certain facies problems, correlation between the different sections of the Niur formation is possible. The main differences between the Robate-Gharabil and Boz-Kuh sections are the presence of trachy-andesite in the latter and the greater development of limestones in the lower part of the Robate-Gharabil section.

LOWER DEVONIAN

Padeha formation

This formation is 492 m thick in the type section. It is composed of well-bedded sandy dolomites in the lower and red brown sandstones and gypsum with some intercalations of dolomites in the upper part. In the Shirgesht area it consists of 739 m of sandstones with some dolomite layers in the upper part. As reported by Alavi Naini (in press), the Padeha formation consists in the Boz-Kuh Mountains of reddish quartzitic sandstones, shales and dolomites. A similar

succession consisting of reddish sandstones and shales with a 90 m thick gypsum layer at the top has been found in Robate-Gharabil area. Here, this sequence is transitionally overlain by gray, calcareous shales and gray to dark-gray limestones of Middle Devonian (Couvinian) age. Since the corals of the sandy limestones at the top of the Niur formation are of latest Silurian age, a Lower Devonian age can be admitted for the Padeha formation.

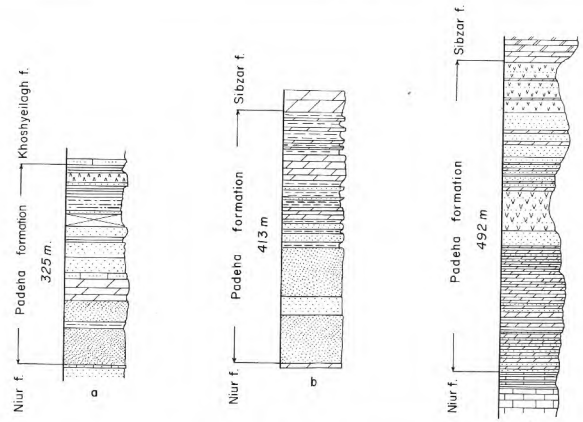
MIDDLE AND UPPER DEVONIAN

Khoshyeilagh formation

The name Geirud formation was introduced by Assereto (1963). In this formation he included Upper Devonian, Lower Carboniferous and Lower Permian? strata (member A to D) of the central Alborz Mountains. In the same publication he proposed the name Mubarak formation (correct Mobarak formation) for a rock-unit which is almost indentical lithologically with the member B and C of the Geirud formation. At the type locality of the Geirud formation in the upper Jajrud valley, the Upper Devonian rocks can be clearly separated from those of the Lower Carboniferous by a consipicuous disconformity indicated by the development of a 20 m thick conglomeratic bed at the base of the Carboniferous. Moreover, in certain other sections of the central Alborz, such as the Mobarakabad and Valiabad sections, a similar conglomerate is developed at the base of the Lower Carboniferous.

The upper rock-unit of the Geirud type section is a cliff-forming dolomitic limestone and dolomite. Laterally it changes in both directions into a highly fossiliferous limestone. The domlomitisation of this rock-unit is a phenomenon restricted to the Geirud section hence it has no regional signifincance.

Due to the mentioned disconformity and the different lithologies (see correlation chart) between the Upper Devonian and Lower Carboniferous strata, these rock-units (A and B to D) should not be lumped together into one single formation.



Lower Devonian sections, Scale 1: 5000

a, Robate-e-Gharabil (measured by: A. Afshar-Harb)

b, Boz-Kuh (measured by: M. Alavi-Naini)

c, Type section (measured by: A. Ruttner, M.H. Nabavi & M.Alavi)

For the Middle and Upper Devonian rocks the new name of Khoshyeilagh formation is here proposed. On the other hand, the Lower Carboniferous rocks (Touranaisian to Viseen) would represent the Mobarak formation. If these changes are accepted, the Geirud formation in the sense of Assereto is no longer needed.

Recent work of H. Bozorgnia, A. Bayat, A. Memear and M. Mohajer (unpublished NIOC report, 1970) in the eastern part of the central Alborz revealed the presence of a highly fossiliferous and thick sequence of Middle and Upper Devonian sediments. H. Bozorgnia describes this section as follows:

"The area, in fact, is one of the few places where highly fossiliferous Middle and Upper Devonian rocks are found. The surveyed section is situated 15 km W of Khoshyeilagh village and crossed by the Shahrud-Shahpasand road. Beginning of the section is on the northern slope of the Khoshyeilagh pass and it ends at 2 km NW of the village, geographical coordinates of the base of which are 55°,2' eastern longitude and 36°,45' northern latitude. The section includes over 1300 m of sedimentary rocks mainly shallow marine, ranging in age from Couvinian through Famennian and is by far the most complete of all Devonian sections so far reported from the Alborz Range.

Regarding the great thickness and better development of the Middle-Upper Devonian rocks in the Khoshyeilagh area, it is more convenient to choose this section as the Devonian type section of the Alborz Mountains instead of the Geirud in which only the lower 140 m consisting of alternating yellowish gray sandstone, dark gray biogenic, calcarenite and black shales are of Frasnian? - Famennian age. The Couvinian and Givetian stages which are recorded in the lower and highly fossiliferous part of the Khoshyeilagh section are completely missing in the Geirud area. Consequently, the name "Geirud formation" should be dropped and replaced by that of Khoshyeilagh formation which designates the Middle and Upper Devonian strata of the Alborz Mountains. The Tournaisian and Visean stages, however, would still be represented by the Mobarak formation as previously proposed (Assereto, ref. cit.).

In the Khoshyeilagh section the upper boundary, between the Upper Devonian and Lower Carboniferous is placed at the base of the ridge forming, micritic limestone of lower Tournaisian age. The lower boundary, however is marked by a 14 m thick conglomerate.

The sequence underlying the conglomerate constitues two lithological units: brown-red, ferruginous, quarzitic sandstone overlain by alternating blue-green, thin-bedded sandstones, siltstones, shales and dark-gray to black limestone layers. Both are assumed to be of Lower Devonian age.

The fossils were collected by the author and his collaborators in several trips to the area and also by I. Yassini and A. De Lapparent. The collected brachiopods were sent to Miss D. Brice and the attributed ages are based on her determinations.

The lithological sequence commencing from below the prominent east-west trending and cliff forming Tournaisian limestones downwards is as follows:

17 Dark gray, somewhat carbonaceous, shale with thick bioclastic limestone beds 100 m
Fossils : *Dichospirifer priformis* BRICE, *Centrorhynchus charakensis* (BRICE) *Megalopterorhynchus* sp., *Cleiothyridina* cf. *reticulata* STAINBROOK *Cyrtospirifer* sp.
Age : presumably Upper Famennian.

16 Alternating bioclastic limestone with abundant poorly preserved brachiopods and gray shale 375 m
Fossil : *Cyrtospirifer* sp.

15 Gray, rubby, somewhat ferruginous, bioclastic, argillaceous limestone 40 m

14 Interbedded gray, bioclastic ferruginous limestone and gray to light-green shale 60 m
Fossils : *Cyrtospirifer* sp., *Dmitria* aff. *seminoi* (VERNEUIL),

Centrorhynchus aff. *charakensis* (BRICE), *Productella baitalensis* REED.
Age : Famennian

13 Brown red, calcareous, quarzitic sandstone 145 m

12 Gray to dark gray thin-bedded, argillaceous limestone and gray shale 90 m

11 Gray-green shale with thin, bioclastic limestone beds 91 m

10 Thick-bedded darg gray bioclastic limestone with gray shale partings 63 m

9 Gray, rubby, argillaceous limestone, thick-bedded, dark gray bioclastic limestone and light green-gray shale 112 m
Fossils : The above mentioned rock units (9, 10, 11 and 12) contain abundant cf. *Whidbornella productoides* (MURCHISON), *Spinatrypa* sp., *Cyrtospirifer* cf. *schelonicus* NALIVKIN
Age : Frasnian

8 Dark gray, well-bedded, argillaceous, limestone, bedding 20-30 cm. 59 m

7 Very porous, limonitic and dolmitic limestone, absolutely barren 58 m

6 Thick bedded, dark gray dolostone, on weathered surface brown gray 29 m

5 Alternating gray, argillaceous to silty limestone and light gray calcareous sandstone 52 m
Fossils : *Spinatrypa* sp., *Spinocyrtia* sp., *Cupularostrum* nov. sp., *Athyris* sp., *Chonetes* sp., in addition to these forms abundant *Tentaculites* sp. and Trilobites have been collected from this rock unit.

Age : Upper Couvinian to Lower Givetian

4 Dark gray siltsone with thin beds of ferruginous highly fossiliferous limestone 30 m
Fossils : *Mesodouvillina birmanica* (REED)?, *Sulcathyris* sp., *Schizophoria* cf. *schnuri* STRUVE, *Spinocyrtia* aff. *ostiolata* (SCHLOTHEIM), *Sulcathyris* aff. *periplicata* (REED), *Leptaena* sp., *Cyrtina heteroclita* (DEFRANCE).
Age : Couvinian

3 Weathered diabase

2 Gray and blue-green tuffaceous siltsone, sandstone and 10-15 cm thick limestone

1 Conglomerate with predominantly basaltic components, some brown red quartzite and gray dolomite pebbles interbedded with dark brown red sandstone and shale. 14 m

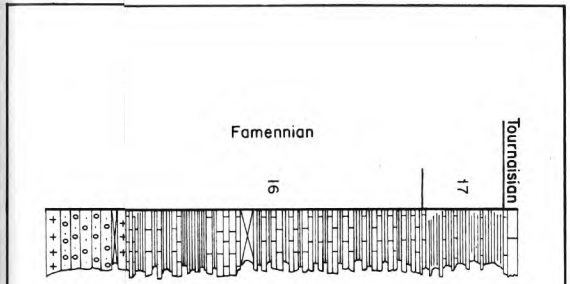
Total thickness 1.354 m"

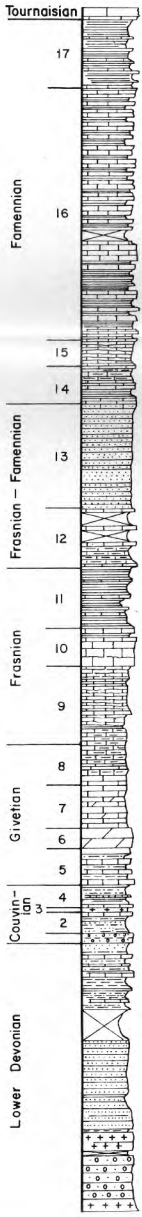
Micropaleontological zonation

Two distinct biozones have been established in the Khoshyeilagh formation. They are from bottom to top:

Trochiliscus zone: The lowest stratigraphic biozone of the Khoshyeilagh formation is defined by the abundant occurrence of the algal genus *Trochiliscus*. The age of this zone is Couvinian as based on brachiopods.

Umbella zone: The most distinctive biozone of the Upper Devonian in Iran is the *Umbella* zone. The age of this biozone is late Frasnian to early Famennian. It is widespread throughout the east and east central Alborz, and also east and central Iran. No representative of this algal genus has been encountered in the central Alborz and therefore it can be assumed that only rocks of middle to upper Famennian





Khoshyeilagh Section

Scale 1:5000

by

H. Bozorgnia

Tr. 4220

age occur in this region.

Besides these two zone-indicating genra the following microfossils have been recorded in this succession:
Cryptophyllus sp., *Archaesphaera magna, Archaesphaera minima Bisphaera irregularis* and *Girvanella wetheredi.*

The ostracod genus *Cryptophyllus* is very abundant in the Givetian and Frasnian sediments but it has also been sporadically encountered in the upper Visean of the central Alborz.

A sample collected from a gray shale about 2 m below the basalt in the Geirud section was studied by Mr. M. Vanguestaine, Laboratoire de Paléontologie Végétal de l'Université de Liége, who communicated the presence of the following species of spores (letter of 16 Decembre 1971):

Hymnozonotriletes lepidophytus, Retusotriletes planus, Retusotriletes punctatus, Corbulispora sp., and an acritarch *Gorgonisphaeridium* cf. *winslowae.*

The age of this sample is Strunian, hence the massive conglomerate overlying the basalt represent the base of the Carboniferous.

LOWER CARBONIFEROUS

Mobarak formation

The Mobarak formation was proposed by Assereto (1963) for sediments from the top of the Mila formation to the base of the Permian. In the defininition of the Mobarak formation he stated:

> "This formation has been created to indicate a thick calcareous sequence overlying the Mila formation, in the Imam Zadeh Hashim Range".

Here, Assereto did not consider the presence of the previously mentioned conglomerate at the base of the Lower Carboniferous, nor

did he refer to any Devonian fossils in this section. However, in 1964 Assereto and Gaetani revised the description of the Mobarak formation. In this revision they mentioned that the sandtones and shales immediately overlying the quartzitic sandstones of their "Mila formation" are of Upper Devonian age. Consequently, they restricted the Mobarak formation to the limestone sequence overlying the Upper Devonian sandstones and shales and underlying the Carboniferous-Permian disconformity.

The Mobarak formation, as described by Assereto and Gaetani, does not include the complete sequence of Lower Carboniferous sediments due to the absence of middle and upper Visan in the type section area. The Lower Carboniferous strata are better developed in some other sections such as Dozdehband, Abnak and Gaduk. But because this formation name is well known in the geological literature of Iran, it is not considered convenient to replace it by a new formation name.

It has been pointed out that in the Geirud section, the Mobarak formation is represented by members B and C of Assereto's "Geirud formation". In the Abnak section, east of the Geirud valley, the upper 300 m of the section consisting of black, oolitic limestones with thin intercalations of dark-gray marls were named member D by Assereto. On the basis of the following macrofauna determined by Fantini Sestini (1966), this unit was placed into the Lower Permian:

Streptorhynchus cf. *bioni, Derbyia* sp., *Taeniothaerus iranicus, Taeniothaerus* cf. *permixtus, Krotovia curvirostris, Waagenoconcha abnakensis, Stepanovella rossiae, Stepanovella* cf. *umariensis. Pseudosyrhyngothyris?* sp., *Neospirifer fasciger paucicostolatus, Martinopsis orientalis, Spirigerella* sp., *Mourlonia?* sp., and *Ditymopygae* sp.

Later Mehrnush (in Stepanov, 1971) reported the following foraminifera from member D of the Abnak section:

Endothyra sp., *Ammodiscus* sp., *Globivalvulina* sp., *Agathammina* sp., and *Biseriammina* sp.

The microfauna of member D of the "Geirud formation" exposed in the Abnak section, was studied by the author. The result does not support neither the Lower Permian age as proposed by Fantini Sestini, nor the presence of the microfauna as reported by Mehrnush. According to the author's determinations the following microfossils occur in member D.

Archaediscus (Archaediscus) stilus, Archaediscus (Archaediscus) karreri, Archaediscus (Paraarchaediscus) mixtus, Archaediscus (Paraarchaediscus) lenitortus, Archaediscus (Paraarchaediscus) rigens, Archaediscus (Paraarchaediscus) preconvexus, Archaediscus (Permidiscus) rotundus, Endothyra sp., *Earlandia vulgaris, Earlandia minor, Pseudoammodiscus* sp., *Tetrataxis* sp., *Endothyra apposita, Endothyra cf. inflata, Girvanella ducii, and Girvanella wetheredi.*

This assemblage clearly indicates an early middle Visean age for this interval. As a result this member is placed into the Mobarak formation.

Biostratigraphic zonation

The following zones are identified in the Lower Carboniferous sediments of the Alborz Mountains:

1. *TOURNAISIAN*

Earlandia minor zone

In those parts of the Alborz Mountains, where the Upper Devonian and Lower Carboniferous deposits are apparently continuous, their boundary cannot be identified with the help of foraminifera. All the diagnostic forms characterizing the lower and middle Tournaisian of Eurasia and North America such as:

Quasiendothyra kobeitusana, Quasiendothyra communis, Endothyra paracosvensis, Endothyra latispiralis, Chernyshinella glomiformis

and *Paleospiroplectammina chernyshinensis* are here missing. The absence of these forms is probably due to the unfavorable ecologic conditions. In this respect, the lower Tournaisian sequence in Iran is similar to that of the North Siberian platform reported by Lipina (1970).

In the present report, the lower boundary of the Tournaisian is placed where *Earlandia minor* appears for the first time in the section. This zone is characterized by the joint occurrence of foraminiferal species of different stratigraphic ranges such as:

Bisphaera irregularis, Archaesphaera magna, Archaesphaera minima, Eotuberitina reitlingerae, Diplosphaerina sp. and *Radiosphaera* sp.

This zone is believed to be of lower and middle Tournaisian age.

Septabrunsiina krainica zone

This zone is characterized by the abundant occurrence of *Septabrunsiina krainica* and *Septebrunsiina kingirica* together with *Earlandia vulgaris*. The genus *Septabrunsiina* is reported from the middle Tournaisian of the Russian platform, Ural (Lipina, 1970), Franco-Belgian basin (Conil & Lys, 1964) and also from the middle and upper Tournaisian of North America (Mamet & Skipp, 1970). *Earlandia vulgaris*, which has never been reported from sediments underlying the upper Tournaisian, indicates an upper Tournaisian age (i.e. Tn3a, b) for this zone.

Paleospiroplectammina diversa zone

Besides the zonal marker, the most impotant faunal elements are: *Darjella monilis, Tounayella moelleri, Tournayella gigantea* var. *minoris* and *Tetrataxis* sp., In addition *Septabrunsiina krainica, S. kingirica* and *Earlandia vulgaris* are still present.

This faunal assemblage characterizes the upper part of the upper Tournaisian. This zone may be correlated with the upper part of the

Spinoendothyra zone and the lower part of the *Endothyra elegia* zone of the Russian platform (Lipina, 1970). It is pointed out that in Iran *Endothyra inflata* and *Endothyra recta* appear higher in the section than *Paleospiroplectammina diversa*, whereas in the Russian platform opposit conditions are reported.

2. *VISEAN*

Dainella chomatica zone

This zone is marked by an abrupt change in the faunal elements. It is characterized by the flood-like occurrence of the endothyrid foraminifera.

The lower boundary of this zone is defined by the first appearence of various species of *Dainella* and *Eoparastaffella* and also by the evolutionary disappearence of the genus *Septabrunsiina*. The important species of this zone are:

Eoparastaffella simplex, Dainella chomatica forma *staffelloides, Dainella chomatica* forma *typica, Dainella chomatica* forma *magna, Dainella elegantula* forma *typica, Dainella elegantula* forma *ventrosa, Dainella alborzensis, Dainella densaspira, Dainella exuberans, Dainella fleronensis, Dainella tumultuosa, Lysella umbilicata, Lysella crassisepta, Lysella schubertelloides, Lysella multicamerata, Lysella scitula, Lysella conferta, Lysella mediocriformis, Endothyra recta, Evdothyra laxa*, and *Endothyra inflata*. The following forms appear for the first time sporadically:

Paleospiroplectammina sinensis, Palespiroplectammina mellina Paleospiroplectammina guttula, Endospiroplectammina conili, Tournayellina beata, Tournayellina pentacamerata, Darjella parvula, Brunsia spirillinoides, Tetrataxix conica, Tetrataxia planulata and *Tetrataxis hemisphaerica* var. *elongata*, wheras *Paleospiroplectammina diversa, Tournayella discoidea, Tournayella gigantea* var. *minoris, Tournayella moelleri* and *Darjella monilis* are still present. This zone, which is well developed in the Gaduk section correlates with the *Dainella*

chomatica - Endothyranopsis transita zone of the Ural and Volga-Ural regions and the Donetz basin of the USSR (Reitlinger, 1970). The age of the zone is early lower Visean.

Permodiscus rotundus - Paraarchaediscus rigens zone

The important foraminiferas of this zone consist of the following species:

Archaediscus (Paraarchaediscus) rigens, Archaediscus (Paraarchaediscus) lenitortus, Archaediscus (Paraarchaediscus) miloni, Archaediscus (Paraarchaediscus) preconvexus, Archaediscus (Archaediscus) stilus, Archaediscus (Planoarchaediscus) eospirillinoides, Archaediscus (Permodiscus) rotundus, Archaediscus (Permodiscus) abnakensis, and *Endothyra conexa exelikta.*

For the first time in this zone appear also *Pseudolituotubella tenuissima, Forschiella prisca, Endothyra bradyi, Endothyra acantha, Endothyra apposita, Mstinia* sp. 1 and *Aoujgalia?* sp., commonly occur also various species of *Dainella* and *Lysella.*

This zone can be correlated with the *Planodiscus primaevus-Permodiscus rotundus* zone of the Donbass territory of the USSR (Reitlinger, 1970) and with the zone 10 of North America (Mamet & Skipp, 1970) The age is late early to early middle Visean.

Rugosoarchaediscus - Endothyra omphalota var. parvula-

Archaediscus convexus zone

This zone is characterized by the first appearence of *Paleotextularia* sp., *Koninckopora* sp. and various species of *Archaediscus Rugosoachaediscus).* The most important fanual elements of this zone are: *Archaediscus (Rugosoarchaediscus) cornua, Archaediscus (Rugosoarchaediscus) demaneti, Archaediscus (Rugosoarchaediscus) tchalussensis, Archaediscus (Archaediscus) pulvinus, Archaediscus Archaediscus) convexus, Endothyra convexa regularis* and *Ebdothyra omphalot* var. *parvula.* Some representatives of the subgenus *Neo-*

archaediscus appear sporadically in the upper most part of this zone.

The zone coincides approximately with the *Eondothranopsis compressus* and *Eostaffella proikensis - Archaediscus gigas* zones, reported from the Russian platform, Ural, Donetz basin and central Asia (Reitlinger, 1970.) Its age is late middle to early late Visean. It should be noted that the genus *Endothyranopsis* which is widely distributed in Eurasia as well as in North America, has so far not been observed in the Carboniferous sediments of the Alborz Mountains.

Neoarchaediscus - Howchinia gibba - Bradyina lucida zone

Most of the fanual elements listed in the above-mentioned zone are also present here. The lower boundary of the zone is placed where *Archaediscus (Archaediscus) moelleri* appears for the first time. The subgenera *Neoarchaediscus* and *Rugosoarchaediscus* reach their maximum development with the following species:

Archaediscus (Neoarchaediscus) pirleti, Archaediscus (Neoarchaediscus) planus, Archaediscus (Neoarchaediscus) exiguus, Archaeriscus (Rugosoarchaediscus) tchaboksarensis, Archaediscus (Rugosoarchaediscus) conili, Archaediscus (Rugosoarchaediscus) karreriformis, Archaediscus (Rugosoarchaediscus) stellatus, Archaediscus (Rugosoarchaediscus) latispiralis, Archaediscus (Rugosoarchaediscus) mutans, Archaediscus (Rugosoarchaediscus) cornua, and Archaediscus (Rugosoarchaediscus) permodiscoides.

In addition, *Howchinia gibba, Bradying lucida* and *Koninckopora minuta* appear for the first time.

This faunal assemblage is smilar to that of the *Eostaffella ikensis* zone of the USSR (Reitlinger, 1970) and to zone 16i of the North America (Memet & Skipp, 1970). It is of middle late Visean age, (V3b).

Asteroarchaediscus baschkiricus - Neoarchaediscus incertus zone.

The base of the zone is placed at the evolutionary appearence of

the subgenus *Asteroarchaediscus* and the disappearence of *Howchinia gibba*. The most important faunal elements of this zone are:

Archaediscus (Neoarchaediscus) incertus, Archaediscus (Neoarchaediscus) gregorii, Archaediscus (Asteroarchaediscus) baschkiricus, Archaediscus (Asteroarchaediscus) rugosus, Archaediscus (Asteroarchaediscus) postrugosus. Most of the species of the subgenera *Neoarchaediscus* and *Rugosoarchaediscus* which are reported in the underlying zone continue into this zone which correlates approximately with the *Eostaffella tenebra* zone of the Russian platform and with zone 16s of North America (Mamet & Skipp, 1970). It is of upper late Visean age (V3c).

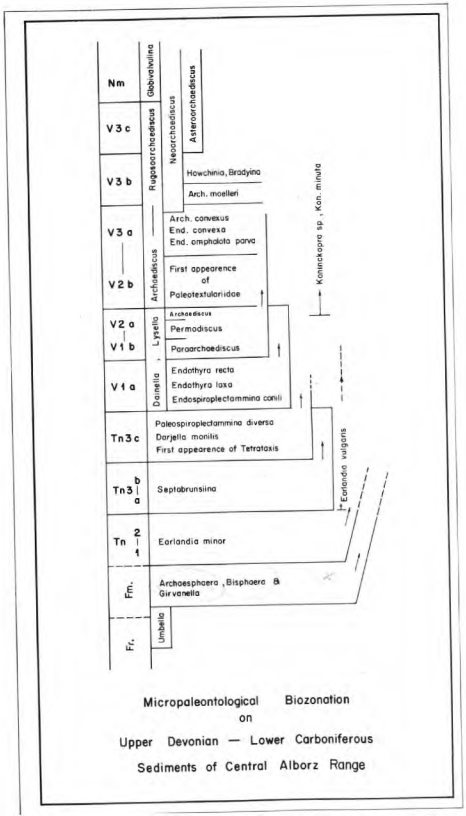
3. NAMURIAN

Assereto (1963) proposed the name Dorud formation for the rock sequence overlying the dolomites and dolomitic limestones of the «Geirud formation» in the upper Jajrud valley. This formation consists of reddish sandstones, siltstones, shales, gray marly limestones, quartzites and conglomerates with a gray, massive, fusulinid-bearing limestone in the middle part. He subdivided the formation into four differend rock-units, of which the lower unit e.i.

unit 1 consists of yellow-gray clayey marls alternating with red or green marly limestones, reddish shales, and thin beds of reddish quartzite.

Ahmadzadeh (1971) who studied the conodonts, established the presence of *Prioniodina galea* in this unit which is suggestive of an upper Visean to lower Namurian age. The present microfaunal study corroborates this age determination. The following foraminifera has been identified in the samples collected from unit 1 of the Dorud formation of the Dozdehband section:

Archaediscus (Asteroarchaediscus) baschkiricus, Archaediscus (Asteroarchaediscus) postrugosus, Archaediscus (Asteroarchaediscus) rugosus, Archaediscus (Neoarchaediscus) incertus, Archaediscus



(Neoarchaediscus) gregorii, Archaediscus (Rugosoarchaediscus) latispiralis, Archaediscus (Rugosoarchaediscus) pirleti, and Globivalvulina sp.

The presence of *Globivalvulina* in this faunal assemblage indicates a lower Namurian age for this rock-unit.

The overlying unit 2 of the Dorud formation in the sense of Assereto is a conglomerate, marking the Permian transgression on unit 1. Although there is an important gap in sedimentation, the contact between these units is almost conformable. It would be more logical to take this conglomerate as the basal rock-unit of the Dorud formation and create a new formation for the clastic and carbonate rocks of lower Namurian age overlying the limestones of the Mobarak formation and underlying this conglomerate. Due to the better development of this rock sequence in the Dozdehband area, the author suggests the name of Dozdehband formation for what formerly called unit 1 of the Dorud formation (Assereto, 1963).

4. LOWER MOSCOVIAN

On the central and southern flancs of the Alborz Mountains, no sediments younger than Namurian have so far been observed. A sample collected by H. Huber from the vicinity of the village of Now-Deh in the Gorgan area yielded a rich microfauna consisting of:

Fusulinella sp., *Ozawainella* sp., *Pseudostaffella* sp., and *Bradyina* sp.

This assemblage indicates a lower Moscovian age for this sample. It suggests the presence of rocks equivalent in age to those of the Sardar formation of the Tabas area in central Iran. The relation of these sediments with those of the older Carboniferous formation of the Alborz Mountains, is not yet clear.

PERMIAN

LOWER PERMIAN

In the Alborz Mountains, the Lower Permian deposits overlie transgressively the older rocks and show clearly the beginning of a new sedimentary cycle that starts with a conglomerate and ends with red shales and quartzites separated by a massive, shallow-water limestone. This cycle is represented in the type section of the Dorud formation by Asserato's units 2 to 4. The middle unit or unit 3 of the Dorud formation, consists throughout the central and eastern parts of the Alborz Mountains of gray, massive fusulinid-bearing limestones of variable thickness. Its thickness is about 50 m in the upper Jajrud valley and 250 m in the Khoshyeilagh area. The unit contains a rich brachiopod fauna which was studied by Fantini Sestini (1965) who assigned a Lower Permian (Darvasian) age to this part of the section. Stoecklin (1971) placed all 4 units of the Dorud formation in the Lower Permian. Examinations of the limestone samples of this formation yielded the following foraminifera.

Pseudoschwagerina sp., *Triticites* sp., *Ammovortella* sp. and some geinitzinids. The presence of the genera *Pseudoschwagerina* and *Triticites* indicates a Sakmarian age for this unit. Hence a hiatus, though minor, exists between the Dorud formation and the overlying Ruteh formation.

UPPER PERMIAN

1. *Ruteh formation*

In 1963 Assereto designated the name Ruteh formation for a rock-unit overlying the grayish quartzites characterizing the top of the Dorud formation and underlying the oolitic limestones and reddish, thinly bedded calcareous «breccias» of the Triassic (Elika formation of Glaus, 1964) in the central Alborz. The type section of this formation is situated in the Ruteh valley at southern flanc of Zarband-Kuh. The formation consists here mostly of blackish limestones with some black

marl intercalations in the lower part. It is subdivided by Assereto into 6 rock-units. The uppermost unit (Unit 6) is composed of about 70 m of gray, massively to indistinctly bedded limestones with an ironstone bed about 25 m under the Permian-Triassic disconformity. The samples collected from the strata overlying this ironstone bed yielded a rich Julfian fauna and permitted correlation of these beds with those of the upper Nessen formation (sensu Stepanov et al., 1969). Hence the Ruteh formation is here considered to be composed only of the beds overlying the Dorud formation and underlying the above-mentioned ironstone bed. Its total thickness does not exceed more than 205 m in the type section. The lithology of the Ruteh formation changes into a gray to light gray, marly limestone in the eastern part of the Alborz Mountains, i.e. in the Damghan and Shahrud regions. The microfaunal assemblage of this formation consists of smaller and larger foraminifera such as:

Neoschwagerina sp., *Chusenella* sp., *Minojapanella* sp., *Schubertella* sp., *Climacammina moelleri, Climacammina valvulinoides, Climacammina major, Cribrogenerina sumatrana, Langella perforata, Langella conica, Langella çukurköyi, Langella venosa, Langella acantha, Langella ocarina, Geinitzina postcarbonica, Geinitzina taurica, Geinitzina uralica, Geinitzina reperta, Geinitzina chapmani* var. *longa, Pachypholoia pedicula, Pachyphloia iranica, Pachyphloia çukurköyi, Globivalvulina vonderschmitti, Neoendothyra reicheli, Neoendothyra broennimanni* and *Neoendothyra parva.*

In addition the following algae have also been encountered:

Gymnocodium sp., *Permocalculus* sp., *Vermiporella* sp., and *Mizzia* sp.

The vertical distribution of the above listed foraminifera in different sections of the Ruteh formation allowed a subdivision into 2 parts:

The lower part is characterized by the abundant occurrence of *Langella perforata, Climacammina major, Climacammina valvulinoides, Cribrogenerina sumatrana, Chusenella* sp. and *Minojapanella* sp.

Similar assemblage have been reported from the upper Artinskian to middle Murghabian of central Afghanistan (Lys and De Lapparent. 1971).

The upper part is defined by the first appearence of *Pachyphloia iranica, Pachyphloia çukurköyi, Langella conica, Geinitzina postcarbonica, Geinitzina taurica, Neoendothyra reicheli, Neoendothyra broennimanni, Neoendothyra parva,* and *Neoshwagerina* sp. Certain representatives of this fauna have also been found in the upper Murghabian of central Afghanistan (ref. cit.). The genus *Neoendothyra* has been reported for the first time from the Khachik beds of the Transcaucasian territory (Reitlinger, 1965). Hence it could be concluded that the upper part of the Ruteh formation can be correlated with the Khachik beds of the Julfa region and is of upper Murghabian age.

2. *Nessen formation*

The name Nesen formation (correct Nessen) was originally proposed by Glaus (1964) to include a 229 m thick rock-unit consisting of dark limestones and shales, overlying the melaphyre and agglomerate of the Murghabian Ruteh formation and underlying the gray, well-bedded limestone of the Elika formation. The type section of this formation is located at about 14 km northwest of Nessen village on the north flanc of the Alborz Mountains. Later on Glaus (1965) and Fantini Sestini and Glaus (1966) subdivided the Nessen formation into 2 parts. The lower part consists of 85 m black shales, marly limestones and limestones, which they found to be equivalent of the upper part of the Ruteh formation. The upper part composed of 144 m of alternating black marly shales and nodular limestones contains a Julfian fauna. In 1969, Stepanov, Golshani and Stoecklin proposed to restrict the name Nessen formation of upper part only, namely the beds 4 to 9 of the Nessen section of Glaus (1965).

The microfaunas examined by the writer corroborates this proposal. The following foraminiferas appear for the first time in the Nessen formation:

Dagmarita chanakchiensis, Paraglobivalvulina mira, Pseudolangella fragilis, Ichtyolaria latilimbata, Ichtyolaria primitiva, Ichtyolaria nessenensis, Protonodosaria praecursor, Reichelina sp., and *Paleofusulina* sp. In addition the following foraminifera are still present: *Pachyphloia iranica, Pachyphloia çukurköyi, Geinitzina taurica, Geinitzina postcarbonica, and Pachyphloia pedicula.*

The presence of *Paraglobivalvulina mira* and *Dagmarita chanakchiensis* together with *Reichelina* and *Paleofusulina* in the samples of the upper part of the Nessen formation showed that this formation is the equivalent of the lower Julfian Chanakchen beds of the Transcaucasian territory. Hence it could be concluded that if at all there exists a disconformity between the upper Murghabian and lower Julfian in the northern part of the central Alborz, it is only a minor one.

Areal extent of the Nessen formation

The Nessen formation has been reported from the upper Chalus and Nur valleys (Glaus, 1965) and from the lower Haraz valley (Stepanov et al., 169). It has been recognized in the section of Mobarakabad on the southern flanc of the Alborz Mountains (Fantini Sestini, 1965 c). The present study has shown, that the Nessen formation has in fact a much wider distribution in the southern central Alborz than indicated by the previous workers. Numerous outcrops of the Nessen formation of Julfian age have been observed in an area between the Chalus and Haraz roads in the following localities where it overlies transgressively older rocks.

1) In the section of Mobarakbad, the lower Visean strata of the Mobarak formation are disconformably overlain by the limestones and shales of the Nessen formation. The boundary between the Mobarak and the Nessen formations is marked by limonitic crusts and infiltrations. The samples of the Nessen formation at this locality contain: *Ichtyolaria latilimbata, Paraglobivalvulina mira, Pachyphloia pedicula, Frondina permica,* and *Pachyphloia iranica.* This assemblage is indicative a Julfian age.

2) In the Shemshak valley, the quartzitic sandstones of the upmost unit of Dorud formation in the sense of Assereto (1963) is overlain by a 3 m of gray limestones of Julfian age which contain: *Ichtyolaria latilimbata, Ichtyolaria primitiva, Pachyphloia çukurköyi* and *Paraglobivalvulina mira. This* limestone was erronously attributed by Assereto (ref. cit.) to the Ruteh formation. The Nessen formation is here disconformably overlain by the sandstones and shales of the Lower Jurassic Shemshak formation.

3) In the type section of the Ruteh formation, the rocks overlying the ironstone bed of unit 6 of the Ruteh formation (Assereto, 1963) yielded a similar Julfian faunas as that in the Shemshak valley.

4) On the east side of the Karaj-Chalus road, between Nessa and Hassanakdar, underlying the Triassic Elika formation, occur about 12 m of Nessen limestones. The contact between this limestone and the underlying Dorud formation is a fault contact. Due to the faulting the about 200 m thick limestones of the Ruteh formation have been cut out. On the other hand, the Ruteh formation is well exposed NW of the village of Hassanakdar. The Nessen formation contains at Nessa-Hassanakdar: *Paleofusulina, sp., Pachyphloia çukurköyi, Pachyphloia pedicula, Pseudolangella fragilis, Paraglobivalvulina mira* and *Ichtyolaria latilimbata* suggesting a Julfian Age.

The contact between the Julfian Nessen limestones and the Triassic Elika formation seems to be transitional but most probably it is also disconformable.

IV. REMARKS ON THE SILURIAN TO PERMIAN PALEOGEOGRAPHY OF THE ALBORZ MOUNTAINS

a) *SILURIAN*

Marine Silurian has been recognized in the Robate-Gharabil area, the Kuh-e-Shahvar area north of Shahrud, and in the Boz-Kuh section south east of Semnan (Alavi Naini and Flanfrin, 1970 and Alavi Naini, thesis in press). Silurian rocks may also be present in

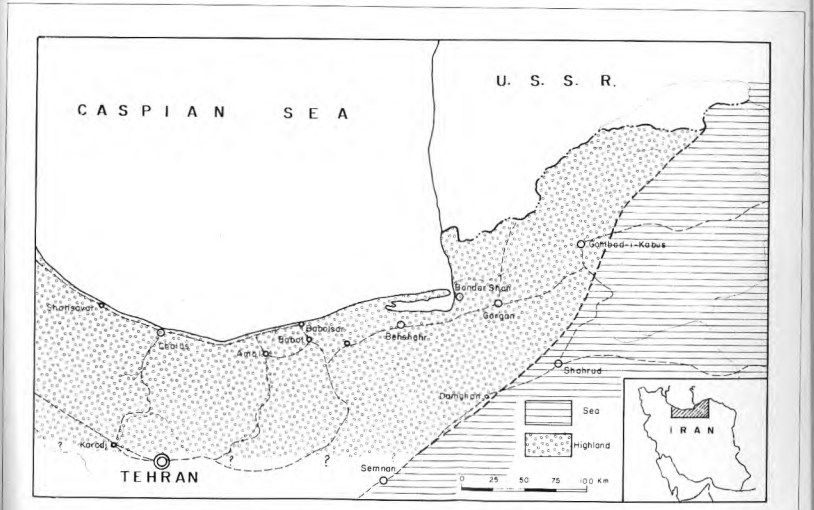


Fig. 1 Silurian paleogeographical map of central and east Alborz Mountains

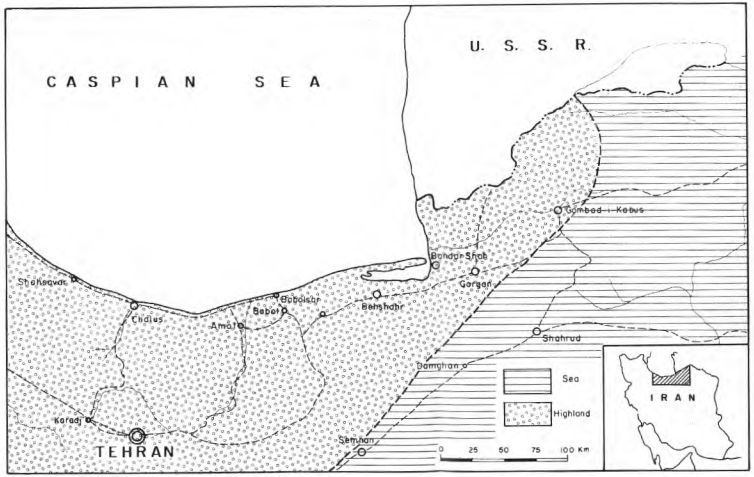


Fig. 2 Middle Devonian paleogeographical map of central and east Alborz Mountains

the Jajarm area in the eastern part of the here considered region. So far no Silurian outcrops have been observed in the central Alborz Mountains. The Silurian sediments consist mostly of red sandstones with subordinate beds of red shales and fossiliferous limestones. (See correlation chart of the Silurian sections). They are marine shallow-water sediments and have been deposited on a slowly subsiding platform-type area. It is believed that the Silurian sea which progressively transgressed from the southeast on to the Caspian land mass was a southern extension of the South European Sea as shown by the paleogeographic maps of the USSR (fig. 1). The direction of the transgression was from SE to NW. The central Alborz was most probably a part of the Caspian land mass of the southern USSR. At the end of the Silurian time a regression took place.

b) *LOWER DEVONIAN*

Lower Devonian sediments have been reported from same localities in which marine Silurian beds have been found.

They are represented by the terrestric lagoonal deposits of Padeha formation which is known at Ozbak-Kuh, east central Iran and in the Kerman area.

c) *MIDDLE - UPPER DEVONIAN*

The Middle Devonian is transgressive in the east and east central Alborz Mountains where marine carbonates and shales of shallow water-type of Couvinian and Givetian age have been deposited. Marine Middle Devonian sediments have been recognized in the Neishabur area west of Mashhad, Jajarm area, Robate-Gharabil section, Khoshyeilagh section, north of Cheshmeh-Ali near Damghan and in Chandaran section north west of Semnan. These sediments contain rich brachiopod faunas and trilobites. Middle Devonian rocks have so far not been observed in the central Alborz hence it can be concluded that during this time interval the central and part of the eastern central Alborz were a highland (fig. 2). This condition continued probably until the end of the early Upper Devonian (Frasnian). During the Famennian time the central Alborz subsided and the late

Upper Devonian sediments trasgressively overlapped on the older rocks of the Caspian land mass. The direction of the transgression remained the same as during the Silurian. West of the Chalus road no marine Devonian deposits have been observed and it seems that the limit of the Famennian sea did not extend much over the Chalus road. In the central Alborz occurred a minor positive epeirogenetic movement at the end of the Devonian. It is marked by conglomerate at the base of the Carboniferous. The east and eastern part of the central Alborz, on the other hand, remained submerged from the Famennian to Lower Carboniferous.

d) *LOWER CARBONIFEROUS*

The Carboniferous is well developed on the north flanc of the Alborz Mountains, where sediments from the Tournaisian up to Namurian have been recognized. In the Now-Deh region near Shahpasand, sediments of Middle Carboniferous (lower Moscovian) age have been found.

Except for the Geirud section, in all other Carboniferous sections of the southern flanc of the Alborz Mountains, no sediments younger than early middle Visean have been observed. The tops of these section are of different ages ranging from early lower to early middle Visean. During the upper Visean a positive epeirogenetic movement took place and the southern flanc of the Alborz Mountains was emerged. The early lower to early middle Visean ages of the tops of the sections is caused by differential post-epeirogenetic erosion. This erosional phase continued in this area until the Lower Permian Sakmarian time.

In contrast, the northern flanc of the Alborz Mountains was continuously subsiding, at least until the Namurian time. The presence of lower Moscovian sediments at Now-Deh in the Gorgan area may be suggestive of continuous sedimentation into the Middle Carboniferous in this region.

The lower Namurian sea of the northern Alborz region transgressed toward the south in a small gulf-like extension, (fig. 3). It covered the Geirud area in the southern central Alborz where the

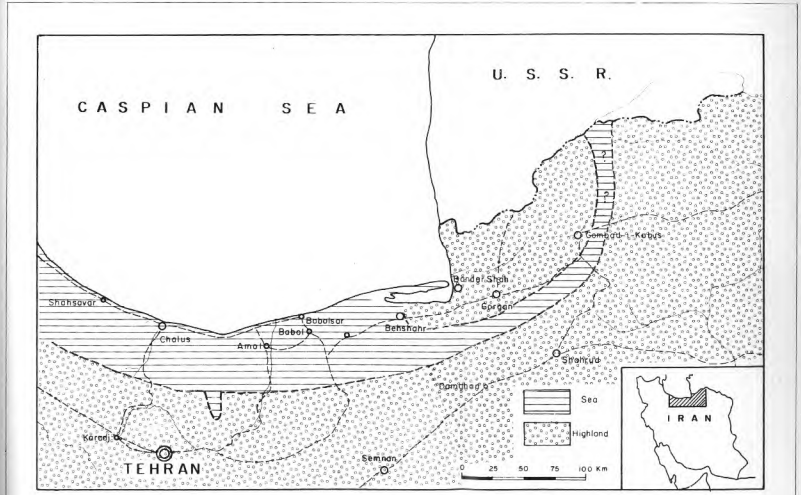


Fig. 3 Namurian paleogeographical map of central and east Alborz Mountains

shales, sandstones and marly limestones of the lower Namurian overlie apparently disconformably the early middle? Visean dolomitic limestones of the Mobarak formation.

No Upper Carboniferous Stephanian rocks have so far been recognized in the Alborz Mountains.

e) *LOWER PERMIAN*

One of the most important events in the Paleozoic geological history of the Alborz Mountains is the Lower Permian transgression. During this time over the whole Alborz region shallow-water marine sediments of Sakmarian age were deposited. The beginning of this transgressive phase is marked by a conglomerate at the base of the sands and carbonates of the Dorud formation. The direction of the transgression could not be established. It possibly goes from south-east to the north-west. At the end of the Sakmarian stage a regression occured and the marine carbonates of the middle rock-unit of the Dorud formation were followed by red sandstones and red coal-bearing shales of terrestric nature. These sediments represent the upper rock-unit of the Dorud formation (Assereto, 1963). It is noteworthy that no rocks of lower Artinskian age have so far been recognized in the Alborz Mountains. However they are present in east central Iran by limestones of the lower part of the Jamal formation.

f) *UPPER PERMIAN*

During upper Artinskian? - Murghabian time the sea again transgressed over the Alborz region. The highly fossiliferous limestones of the Ruteh formation have been deposited in the course of this transgressive interval.

In the uppermost Murghabian the southern flanc of the Alborz Mountains was emerged. This emergence is indicated by an ironstone bed on top of the Ruteh limestone in the type section of the Ruteh formation, in the Aruh and Gaduk sections, and also by a laterite above the Ruteh formation in the section of Bibi-Shahrbanu

south of Tehran. Quite generally the black Ruteh limestones underlying the laterite in Bibi - Shahrbanu area were erronously attributed to the Carboniferous. They contain in fact a rich microfauna typical of the lower to middle Murghabian. This Upper Permian disconformity has not been observed in the type section of the Nessen formation and in the section of the Elika valley. This suggests that marine sedimentation was possibly uninterrupted in the upper Murghabian in the above mentioned areas. In the Amol section, however, the limit between Ruteh and lower Nessen formations is characterized by a limonitisation which indicates a minor disconformity in the upper Murghabian beds.

The upper Murghabian and lower Julfian sediments are apparently continuous in the northern central Alborz. It seems that the Julfian sea transgressed over the southern central Alborz in the area limited by the Chalus and Haraz roads. In this area the Julfian stage is represented by sediments varying in thickness from 3 to 25 meters.

V. SYSTEMATIC PALEONTOLOGY

All specimens described in this paper are deposited in the collections of the Geological Laboratories of the National Iranian Oil Company, Tehran. The measurements are in millimeters.

Phylum CHAROPHYCOPHYTA
Family TROCHILISCACEAE MAEDLER, 1952
Genus TROCHILISCUS KARPINSKY, 1906
Trochiliscus sp.
pl. 1, fig. 1-2

Description

Oogonium large and globular. Wall calcareous and double-layered, outer layer hyaline, fibrous and light-colored, with irregular thickenings and thinning. Inner layer very thin, dark and finely granular. Opening large with a long neck.

Dimensions

Internal diameter of oogonium: 0.5 to 0.6
Thickness of the wall: 0.1 to 0.2

Stratigraphic occurrence

Couvinian of the eastern central Alborz.

Family UMBELLACEAE FURSENKO, 1955
Genus UMBELLA MASLOV, 1950
Umbella bella MASLOV, 1950
pl. I, fig. 6, pl. II, fig. 1-4

1950. *Umbella bella* MASLOV (not seen).

1955. *Umbella bella* MASLOV-BYKOVA, p. 40, pl. X, fig. 3-4, pl. XII, fig. 1-2, pl. XIV, fig. 3-7.

1962. *Umbellina bella* (MASLOV) - OZONLOWA, transl. A.T.S. No. pj-4625, p. 4, text. fig. 2.

1966. *Umbella bella* MASLOV-POJARKOV, p. 178, pl. II, fig. 1.

Description

Urticle subcylindrical with a small basal and somewhat larger apical opening. Inner cavity ovoid. with larger diameter in direction of the axis of utricle. Wall calcareous and double-layered, inneer layer thin, dark and finely granular, outer layer light-colored, fibrous and consists of elongate calcite crystals seperated by numerous very fine pores. Thickness of the outer layer increases very rapidly at the base of utricle, producing a pronounced beard-like projection. Basal opening is situated at the end of a nearly cylindrical canal formed by the projection, showing sometimes a slight enlargement in the middle part. Apical opening rounded and closed by a dark colored lid, composed of the same material as the inner layer of wall.

Dimensions

Length of utricle: 0.45 to 0.55
Breadth of utricle: 0.32 to 0.40
Greatest diameter of the inner cavity: 0.25 to 0.31

Stratigraphic occurrence

This species was described from Middle and Upper Devonian of Kuibishev, Voronezh, Saratov, Olevska and Fergana Regions of the U S S R. It has also been reported from middle Givetian of the Holy Cross Mountains in Poland. In Iran, it occurs in the calcareous sediments of the upper Frasnian to lower Famennian of the eastern central Alborz.

Umbella hemisphaerica POJARKOV, 1966
pl. I, fig. 3-5

1966. *Umbella hemisphaerica* POJARKOV, p. 183, pl. I, fig. 6, 9.

Description

Utricle of medium size for the genus, hemispherical with a very large apical opening. Wall relatively thin, calcareous and double-layered. Outer layer thick, its thickness increasing gradually from the apical opening toward the opposite side.

Dimensions

Length of utricle: 0.33 to 0.46
Breadth of utricle: 0.36 to 0.50
Maximum diameter of the inner cavity: 0.30 to 0.40
Diameter of the apical opening: 0.26 and 0.31

Stratigraphic occurrence

Umbella hemisphaerica was initially described from the Frasnian of the Sumsar Basin in the Fergana region of the USSR. In Iran it seems to have a more restricted stratigraphic range as it is only recorded from the upper Frasnian of the eastren central Alborz.

Umbella ovata BOZORGNIA, nov. sp.
pl. I, fig. 10-12

Derivatio nominis: ovata, ovate

Holotype: pl. I, fig. 10

Locus typicus: Khoshyeilagh pass, NE of Shahrud.

Stratum typicum: Upper Frasnian.

Diagnosis: utricle small, ovoid, with a large apical opening and distinct basal beard-shaped projection.

Description

Utricle small and ovoid. Inner cavity subspherical. Wall calcareous and double-layered, outer layer relatively thick and its thickness increases rapidly from the apical region toward the base. Surface smooth and regular. Apical opening circular and comparatively large, its diameter is nearly equal to that of the inner cavity of the utricle. It is covered by a thin, dark lid.

Dimensions of holotype

Length of utricle: 0.30
Breadth of utricle: 0.24
Greatest diameter of the inner cavity: 0.20

Dimensions of paratypes

Length of utricle: 0.24 to 0.30
Breadth of utricle: 0.20 to 0.24
Greatest diameter of the inner cavity: 0.17 to 0.20

Remarks

Umbella ovata differs from *Umbella nana* its close reative, by having a basal projection in the outer layer and the largeness of its opening. It differs from *Umbella parma* by its smaller size and having a pronounced basal beard-shaped projection.

Stratigraphic occurrence

Upper Frasnian to lower Famennian of the eastern central Alborz.

Umbella baschkirika BYKOVA, 1955.
pl. I, fig. 3, pl. II, fig. 5

1955. *Umbella baschkirika* BYKOVA, p. 38, pl. X, fig. 1-2.

1966. *Umbella baschkirika* BYKOVA-POJARKOV, p. 180, pl. II, fig. 8-11.

Description

Utricle large for the genus and ellipsoid. Inner cavity ovoid, with greatest diameter perpendicular to the axis of the utricle. Wall double-layered, outer fibrous layer thick, its thickness increasing gradually from the apical side toward the base, producing a broad basal projection. Basal opening not observed, apical opening large.

Dimensions

Length of utricle: 0.45 to 0.55
Breadth of utricle: 0.50 to 0.60
Greatest diameter of the inner cavity: 0.35 to 0.45
Diameter of the apical opening: about 0.4

Stratigraphic occurrence

Originally described from the upper Givetian of Bashkirie, the species has also been reported from the Givetian of the Sumsar Basin in the Fergana area. It occurs rarely in the upper Frasnian of eastern central Alborz.

Umbella shahrudensis BOZORGNIA, nov. sp.
pl. II, fig. 6-7

Derivatio nominis: Shahrud, nearest town to the type locality.

Holotype: pl. II, fig. 7

Locus typicus: Khoshyeilagh pass, NE of Shahrud

Stratum typicum: Upper Frasnian

Diagnosis: utricle large and subcylindrical. Wall thick throughout the utricle. Basal projection well developed.

Description

Utricle large for the genus and subcylindrical. Inner cavity

suboval, with greatest diameter perpendicular to the axis of the utricle. Wall double-layered, outer layer with minimum thickness of 0.07 to 0.08 mm. Basal projection well developed. Basal opening obscured. Apical opening reatively small, circular and covered by a thick, dark lid.

Dimension of the holotype

Length of utricle: 0.70
Breadth of utricle: 0.50
Greatest diameter of the inner cavity: 0.32

Dimension of 4 paratypes

Length of utricle: 0.55 to 0.70
Breadth of utricle: 0.45 to 0.52
Greatest diameter of the inner cavity: 0.325 to 0.440

Stratigraphic occurrence

Upper Frasnian to lower Famennian of the eastern central Alborz.

Umbella sumsariensis POJARKOV, 1966
pl. II, fig. 8

1966. *Umbella sumsariensis* POJARKOV, p. 182, pl. II, fig. 3, 5, 10.

Description

Utricle low cylindrical with basal and apical openings. Inner cavity rounded. Wall calcareous and double-layered, outer layer thick with a projection of medium size at the base. Basal opening relatively large and at the inner end of a funnel-shaped canal formed by the basal projection.

Dimensions

Length of utricle: 0.45 to 0.55

Breadth of utricle: 0.41 to 0.43
Diameter of the inner cavity: 0.28 to 0.30

Remarks: this species differs from *Umbella bella*, by having a rounded inner cavity and the funnel-like shape of the basal canal.

Stratigraphic occurrence

Originally described from Frasnian of the Sumsar basin in the Fergana area of the USSR. This species also occurs in the upper Frasnian to lower Famennian of the eastern central Alborz.

Umbella reitlingerae BOZORGNIA, nov. sp.
pl. II, fig. 12-14

Derivatio nominis: this species is named for Mrs E.A. Reitlinger in recognition of her contributions to the paleontology of the Paleozoic.

Holotype: pl. II, fig. 13

Locus typicus: Khoshyeilagh pass, NE of Shahrud

Stratum typicum: Upper Frasnian

Diagnosis: utricle pear-shaped and medium-sized for the genus. Apical face flat. Basal canal funnel-shaped

Description

Utricle elongate, reversed pear-shaped with apical and basal openings. Inner cavity ovate, with greatest diameter in the direction of the axis of utricle. Wall calcareous and double-layered. Outer layer in relation to the size of the utricle thin with a long projection at the base. Apical opening large, circular, with a dark, thick lid. Basal canal funnel-shaped.

Dimensions of the holotype

Length of utricle: 0.40
Breadth of utricle: 0.26
Greatest diameter of the inner cavity: 0.28
Diameter of the apical opening: 0.1

Dimensions of 8 paratypes

Length of utricle: 0.38 to 0.45
Breadth of utricle: 0.20 to 0.28
Greatest diameter of the inner cavity: 0.20 to 0.29

Remarks: this species differs from *Umbella sumsariensis* by its smaller size, pear-like shape of the utricle and also by the less thickness of the wall.

Stratigraphic occurrence

Upper Frasnian-lower Famennian of the eastern central Alborz.

Umbella rotunda BYKOVA, 1955
pl. II, fig. 9, 11

1955. *Umbella rotunda* BYKOVA, p. 44, pl. XI, fig. 8-9, pl. XV, fig. 8-9.

1966. *Quasiumbella rotunda* (BYKOVA) - POJARKOV, p. 186, pl. II, fig. 6.

Description

Utricle medium-sized for the genus, subspheric, with a single apical opening. Inner cavity spheric. Wall calcareous, and double - layered, thickness of the outer layer nearly constant throughout the utricle. Opening situated at the end of a distinct neck and covered by a thick, dark lid.

Dimensions

Length of utricle: 0.48 to 0.58
Breadth of utricle: 0.42 to 0.52
Greatest diameter of the inner cavity: 0.30 to 0.40

Stragtigraphic occurrence

Umbella rotunda was initally described from the Famennian of the Ouriopinsk and Teplovka regions of the USSR. It has been also reported from the upper Famennian of the Sumsar basin. In Iran, it occurs in the upper Frasnian and lower Famennian of the eastern central Alborz.

Umbella nana REITLINGER, 1954
pl. I, fig. 7-9

1954. *Umbella nana* REITLINGER, p. 76-77, pl. XXII, fig. 12

1956. *Quasiumbella nana* (REITLINGER) - POJARKOV, p. 188, pl. I, fig. 25.

Description

Utricle small and ovoid with a single apical opening. Inner cavity ovoid, with greatest diameter in direction of the axis of utricle. Wall calcareous, double-layered and thin throughout. Apical opening relatively large in comparison with the size of the utricle.

Dimensions

Length of utricle: 0.20 to 0.22
Breadth of utricle: 0.15 to 0.20
Greatest diameter of the inner cavity: 0.14 to 0.16
Thickness of the wall: 0.25 to 0.30

Stratigraphic occurrence

Originally described from the Evlamovo formation (Frasnian)

of the USSR. This species has been also found in the middle Frasnian of the Fergana region. In the eastern central Alborz it is restricted to upper Frasnian.

Umbella cutis CONIL & LYS, 1964
pl. II, fig. 10

1964. *Umbella cutis* CONIL & LYS, p. 38, pl. V, fig. 44.

Description

Utricle spheric and medium-sized for the genus. Inner cavity spheric. Wall calcareous, double-layered and antiapically relatively thin. It thickens around the opening, which is large and covered by a thick, dark lid.

Dimensions

Diameter of the utricle	:	0.45
Diameter of the inner cavity	:	0.40
Maximum thickness of the wall:		0.08

Stratigraphic occurrence

Initially described from the middle Famennian of Belgium, it also occurs in the upper Farsnian of eastern central Alborz.

Phylum SCHIZOPHYTA
Family SCHIZOPHYCACEAE (FLAKENBERG), ENGLER, 1892
«Section» POROSTOMATA PIA, 1927
Genus GIRVANELLA NICHOLSON & ETHERIDG, 1880
Girvanella ducii WETHERED, 1890
pl. I, fig. 13

1890. *Girvanella ducii* WETHERED, p. 280, pl. XI, fig. 2.

1949. *Girvanella ducii* WETHERED - MASLOV, Trans. A.T.S., no. Rj. - 3550, p. 5.

1961. *Girvanella ducii* WETHERED - CONIL, p. 635, pl. XVIII, fig. 24.

1964. *Girvanella ducii* WETHERED - CONIL & LYS, p. 25. pl. III, fig. 2.

1965. *Girvanella ducii* WETHERED - TCHUVASHOV, p. 73, pl. XVII, fig. 2.

Description

Thalus consists of small cylindrical tubes that twist in irregular patterns. Tubes are virtually of uniform diameter and without cross partitions. Wall of tubes relatively thick, their interior diameter varies between 0.01 and 0.015 mm.

Stratigraphic occurrence

Girvanella ducii occurs in association with *Girvanella wetheredi* in Famennian to Visean of the Alborz Montains.

Girvanella wetheredi CHAPMAN, 1907
pl. III, fig. 16

1907. *Girvanella wetheredi* CHAPMAN, (not seen).

1961. *Girvanella wetheredi* CHAPMAN - CONIL, p. 353, pl. XVIII, fig. 23.

1964. *Girvanella wetheredi* CHAPMAN - CONIL & LYS, p. 25, pl. III, fig. 1.

Remarks: the present species differs from *Girvanella ducii* by having narrower tubes. The interior diameter of tubes varies between 0.005 and 0.007 mm.

Stratigraphic occurrence

This species occurs in the Famennian and Visean of the Alborz Mountains.

Phylum CHLOROPHYCOPHYTA
Family DASYCLADACEAE KUETZING orth. Mut. STIZENBERGER, 1860
Genus KONINCKOPORA LEE, 1912, emend. WOOD, 1914
Koninckopora minuta WEYER, 1968
pl. XIX, fig. 1-2

1968. *Koninckopora minuta* WEYER, p. 183, pl. II, fig. 1-7, pl. III, fig. 1-4.

Description

Thallus subcylindrical and circular in cross section. Its periphery is formed by honeycomb-shaped cells arranged perpendicularly to the surface. Wall of the cells double - layered. Outer layer dark and microgranular. Inner layer light-colored and fibrous.

Dimensions

Diameter of the cells: 0.08 to 0.1
Total thickness of the wall: 0.2 to 0.22
Number of the cells per mm: 10 to 11

Stratigraphic occurrence

Koninckopora minuta was originally reported from the upper Visean of North Wales, England and Reggane basin of Algeria. It also occurs in the V3c of the central Alborz.

order FORAMINIFERIDA EICHWALD, 1830

Suborder FUSULININA WEDEKIND, 1937

Superfamily PARATHURAMMINACEA BYKOVA, 1955

Family PARATHURAMMINIDAE BYKOVA, 1955

Genus BISPHAERA BIRINA, 1948

Bisphaera irregularis BIRINA, 1948
pl. III, fig. 1-2, 5

1948. *Bisphaera irregularis* BIRINA, p. 159, pl. II, fig. 10.

1955. *Bisphaera irregularis* BIRINA - LIPINA, Trad. B.R.G.M., No 1640, p. 13, pl. I, fig. 1.

1962. *Bisphaera irregularis* BIRINA - BOGUSH & JUFEREV, p. 89-90, pl. I, fig. 24-26.

1964. *Bisphaera irregularis* BIRINA - CONIL & LYS, p. 32, pl. IV, fig. 19-20.

1966. *Bisphaera irregularis* BIRINA - BRADZHNIKOVA & ROSTOVSIEVA, p. 14, pl. III, fig. 10.

Description

Test unilocular, subspheric to suboval with irregular swellings. Wall double-layered, outer layer dark-colored and finely granular, inner layer hyaline and fibrous. Outer surface smooth. Diameter: 0.6 to 0.7 mm.

Stratigraphic occurrence

Famennian to Tournaisian of the USSR.
Tn2b of Belgium
Famennian to V1a of the Alborz Mountains

Bisphaera malavkensis BIRINA, 1948
pl. III, fig. 4, 6

1948. *Bisphaera malavkensis* BIRINA, p. 129, pl. II, fig. 9.

1955. *Bisphaera malavkensis* BIRINA - LIPINA, Trad. B.R.G.M., No 1640, p. 13, pl. I, fig. 13.

1955. *Bisphaera malavkensis* BIRINA - BYKOVA, Trad. B.R.G.M., No 1603, p. 17, pl. IV, fig. 6, pl. V, fig. 5.

1962. *Bisphaera malavkensis* BIRINA - BOGUSH & JUFEREV, p. 89, pl. I, fig. 23.

1966. *Bisphaera malavkensis* BIRINA forma *typica* - BRADZHNIKOVA & ROSTOVSIEVA, p. 12, pl. III, fig. 1-5, 12.

Remarks: this species differs from *Bisphaera irregularis* by having a «belt like» depression all around the test which subdivides it into two distinct parts.

Stratigraphic occurrence

Givetian to the Lower Carboniferous of the USSR.
Tournaisian to V1a of central and eastern central Alborz.

Bisphaera ovoidea CONIL & LYS, 1964
pl. III, fig. 3

1964. *Bisphaera ovoidea* CONIL & LYS, p. 33, pl. IV, fig. 23.

Description

Test large and subspheric. Wall relatively thin and dark-colored, consisting of a single, finely granular layer. Surface of the test smooth, without any depression.

Stratigraphic occurrence

Tnl of Belgium
Vla of the central Alborz.

Genus ARCHAESPHAERA SULEIMANOV, 1945
Archaesphaera minima SULEIMANOV, 1945
pl. III, fig. 8-9

1945. *Archaesphaera minima* SULEIMANOV (not seen).

1955. *Archaesphaera minima* SULEIMANOV - BYKOVA, Trad. B.R.G.M., No 1603 p. 13, pl. I, fig. 2-12, pl. II, fig. 1, pl. IV, fig. 3.

1962. *Archaesphaera minima* SULEIMANOV - BOGUSH & JUFEREV, p. 72-73, pl. I, fig. 3.

Description

Test free, unilocular and globular, its surface covered by several radial spines of different sizes. Wall calcareous and double - layered. Outer layer thick light-colored and fibrous. Inner layer thin, dark and finely-granular.

Dimensions

Diameter of the test : 0.052 to 0.055
Length of spines: 0.042 to 0.044

Remarks: several specimens that seem to belong to those described and figured from the USSR, by BYKOVA were found in the Upper Devonian to middle Tournaisian of the central and eastern

central Alborz. Our specimens are slightly smaller than those of the USSR.

Stratigraphic occurrence

Upper Devonian of the USSR.
Faminnian to middle Tournaisian of the Alborz mountains.

Archaesphaera magna SULEIMANOV, 1945
pl. III, fig. 7

1945. *Archaesphaera magna* SULEIMANOV (not seen).

1955. *Archaesphaera magna* SULEIMANOV - BYKOVA, Trad B.R.G.M., No 1603, pl. II, fig. 2-3.

Remarks: a few specimens resembling those figured on plate II in BYKOVA's paper were found in the upper Famennian to middle Tournaisian of the Khoshyeilagh section. This species is not described in the B.R.G.M., translation of BYKOVA's paper but the comparison of the figures of *A. minima* with those of *A. magna* shows that the latter is much larger in size and has longer spines. The maximum diameter of our specimens is about 0.1 mm.

Stratigraphic occurrence

Upper Devonian of the USSR.
Upper Famennian to middle Tournaisian of the eastern central Alborz.

Family TUBERITINIDAE MIKLUKO - MAKLAY, 1958
Genus DIPLOSPHAERINA DERVILLE, 1952
Diplosphaerina inaequalis (DERVILLE)
pl. III, fig. 12

1931. *Diplosphaera inaequalis* DERVILLE (not seen).

1964. *Diplosphaerina inaequalis* (DERVILLE) - CONIL & LYS, p. 47. pl. VI, fig. 77-81.

Description

Bilocular test consists of a small spheric initial chamber followed by a strongly overlapping, larger second chamber. Wall calcareous, dark-colored and finely granular.

Dimensions

Diameter of the initial chamber: 0.011 to 0.014
Maximum diameter of test: 0.11 to 0.16

Stratigraphic occurrence

Visean of France and Belgium.
Tournaisian to Visean of the central Alborz.

Genus EOTUBERITINA MIKLULO - MAKLAY, 1958
Eotuberitina reitlingerae MIKLUKO - MAKLAY, 1958
pl. III, fig. 11

1950. *Tuberitina maljavkini* REITLINGER, p. 88, pl. XIX, fig. 2.

1950. *Eotuberitina reitlingerae* nov. nom. MIKLUKO - MAKLAY, Trad. B.R.G.M. p. 159.

1962. *Eotuberitina reitlingerae* MIKLUKO - MAKLAY - BOGUSH & JUFEREV, p. 94-95, I, fig. 32.

1964. *Eotuberitina reitlingerae* MIKLUKO - MAKLAY - CONIL & LYS, p. 34, pl. IV, fig. 27-32.

1965. *Eotuberitina reitlingerae* MIKLUKO - MAKLAY - TCHUVASHOV, p. 33, pl. IV, fig. 11-14.

1965. *Eotuberitina reitlingerae* MIKLUKO - MAKLAY - OMARA & CONIL, p. 225, pl. II, fig. 2.

1966. *Tuberitina reitlingerae* MIKLUKO - MAKLAY - BRADZHNIKOVA & ROSTOVSIEVA, pl. I, fig. 25.

Description

Attached unilocular test small, cap shaped to hemispherical, basal disc flat or convex. Wall thin, finely granular and dark.

Dimensions

Breadth of the test: 0.11 to 0.2
Thickness of the wall: 0.005 to 0.01

Stratigraphic occurrence

Lower Carboniferous to Upper Permian of central Alborz.

Family MORAVAMMINIDAE POKORNY, 1951
Subfamily EARLANDIINAE CUMMINGS, 1955

Genus EARLANDIA PLUMMER, 1930
Earlandia elegans (RAUZER - CHERNOUSSOVA & REITLINGER), 1937
pl. III, fig. 15

1937. *Hyperammina elegans* RAUZER - CHERNOUSSOVA & REILINGER, p. 256. fig. 191.

1964. *Earlandia elegans* (RANZER - CHERNOUSSOVA & REITLINGER) - CONIL & LYS, p. 53, pl. VII, fig. 98-99.

1969. *Earlandia elegans* (RAUZER - CHERNOUSSOVA & REITLINGER) - DVORAK & CONIL, pl. I, fig. 1.

Description

Bilocular test small for the genus. Initial chamber subspherical and clearly separated from straight cylindrical second chamber. Wall thin, dark and finely granular.

Dimensions

Diameter of the initial chamber: 0.05 to 0.06
Length of the test: 0.4
Maximum thickness of the wall: 0.01

Stratigraphic occurrence

Tournaisian to lower Namurian of the USSR.
Tournaisian to Visean of Belgium.

Lower to middle Tournaisian of the central Alborz.

Earlandia minor (RAUZER-CHERNOUSSOVA), 1948
pl. III, fig. 13-14, pl. IX, fig. 2

1948. *Hyperammina vulgaris* RAUZER-CHERNOUSSOVA & REITLINGER var. *minor* RAUZER-CHERNOUSSOVA, p. 239, pl. XVII, fig. 1.

1952. *Hyperammina vulgaris* RAUZER-CHERNOUSSOVA & REITLINGER var. *minor* RAUZER-CHERNOUSSOVA-LEBEDEVA, p. 239, pl. I, fig. 1.

1964. *Earlandia vulgaris* (RAUZER-CHERNOUSSOVA & REITLINGER) var. *minor* RAUZER-CHERNOUSSOVA-CONIL & LYS, p. 53, pl. VII, fig. 96-97.

Description

Bilocular test free, consisting of a spherical initial chamber and an undivided, straight cylindrical second chamber. There is a distinct constriction at the junction of the proloculus and the second chamber. The dark wall is made up of finelly granular calcite.

Dimensions

Total length of test: 0.8 to 0.85
Diameter of the initial chamber: 0.12
Maximum thickness of the wall: 0.03

Stratigraphic occurrence

Visean of the USSR.
Upper Tournaisian to Visean of Belgium.
Tournaisian to Visean of the central Alborz.

Earlandia vulgaris (RAUZER-CHERNOUSSOVA & REITLINGER), 1937
pl. IX, fig. 1

1937. *Hyperammina vulgaris* RAUZER-CHERNOUSSOVA & REITLINGER p. 253, fig. 190.

1964. *Earlandia vulgaris* var. *vulgaris* (RAUZER-CHERNOUSSOVA & REITLINGER) - CONIL & LYS, p. 53, pl. VII, fig. 95.

1965. *Earlandia vulgaris* (RAUZER-CHERNOUSSOVA & REITLINGER) - CONIL, p. B225, pl. II. fig. 1.

Remarks: This species differs from *Earlandia minor* and *Earlandia elegans* by its greater dimensions and thicker wall. Although this species is fairly common in the Visean of the central Alborz, no complete specimens showing the initial chamber have been observed.

Dimensions

Maximum length of test: 1.5
Maximum breadth of test: 0.2
Maximum thickness of the wall: 0.05

Stratigraphic occurrence

Visean to lower Namurian of the USSR.
Visean of Belgium.
Upper Tournaisian to Visean of the central Alborz.

Genus DARJELLA MALAKHOVA, 1963
Darjella monilis MALAKHOVA, 1963
pl. VII, fig. 4, 7-8

1963. *Darjella monilis* MALAKHOVA, p. 111-112, pl. I, fig. a-g.

1968. *Darjella monilis* MALKHOVA-CONIL & LYS, p. 501, pl. II, fig. 22.

1970. *Lugtonia* sp. - GORECKA & MAMET, pl. II, fig. 6.

Description

Uniserial test free, elongate, tapering and large, composed of 4 to 5 rapidly in size increasing chambers, which are elongate-subglobular, circular in cross section. Sutures depressed. Aperture simple, terminal with a distinct neck. Wall thick, agglutinated with much cement of microgranular calcite crystals.

Dimensions

Length of test: 2:2 to 2.6
Diameter of the last chamber: 0.8 to 0.85
Diameter of the aperture: 0.22 to 0.28
Maximum thickness of the wall: 0.1

Remarks: possibly *Darjella* and *Lugtonia* are synonym of *Reofax* However, the name *Darjella* is for the time being retained.

Stratigraphic occurrence

Originally described from transitional beds between Tournaisian and Visean (Elchov) of the USSR., it also has been found in the lower part of Visean of Belgium. It occurs in the upper Tournaisian-lowermost Vieasn of the central Alborz.

Darjella parvula BOZORGNIA, nov. sp.
pl. VIII, fig. 9

Derivatio nominis: parvulus (very small).

Holotype: pl. VIII, fig. 9.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: Vla

Diagnosis: this species of *Darjella* is characterized by its small size, thin and microgranular wall.

Description

Uniserial test small, elongate and composed of 4 to 5 chambers. They are inflated, much higher than broad and increasing gardually in size. Sutures depressed. Wall calcareous, dark and finely granular. Relatively large aperture, terminal with a neck.

Dimensions

Length of the test: 0.56 to 0.57
Maximum breadth of the last chamber: 0.11 to 0.13
Diameter of the aperture: 0.022
Maximum thickness of the wall: 0.018 to 0.019

Remarks: this species has only been found in two thin sections of the lowermost Visean of the Gaduk section. It differs from *Darjella monilis* essentially by its smaller size.

Stratigraphic occurrence

Vla of the central Alborz.

Superfamily *ENDOTHYRACEA BRADY*, 1884
Family *TOURNAYELLIDAE DAIN*, 1955
Genus *SEPTABRUNSIINA LIPINA*, 1955
Septabrunsiina kingirica (REITLINGER), 1961
pl. IV, fig. 1-5

1961. *Septaglomospiranella (Septaglomospiranella) ? kingirica* REITLINGER, p. 61, pl. V, fig. 15-17.

1964. *Septabrunsiina crassisepta* CONIL & LYS, p. 75, pl. X, fig. 177-178.

1964. *Septabrunsiina krainica* var. *krainica* (LIPINA) - CONIL & LYS, p. 75, pl. X, fig. 182-183.

1965. *Septabrunsiina kingirica* (REITLINGER) - LIPINA, p. 54. 55, pl. IX, fig. 30-34, pl. XII, fig. 1, 2, 6-8.

1967. *Septabrunsiina kingirica kingirica* (REITLINGER) - CONIL et al. pl. IV, fig. 39.

1968. *Septabrunsiina kingirica* (REITLINGER) - CONIL & LYS, p. 507, pl. IV, fig. 50-53.

Description

Test spirally coiled, large-sized for the genus, evolute, consisting of 4 to 5 volutions. The plane of coiling changes slightly in the initial whorls, the last 2 to 3 whorls are nearly planispiral. Pseudochambers somewhat arched at periphery due to deeply incised sutures.

Proloculus large and spheric. Seven to 9 pseudo-chambers in the last whorl. Septa short and strongly inclined toward the apertural end. Wall calcareous granular with some agglutinated material.

Dimensions

Diameter of test: 0.59 to 0.80
Breadth of test: 0.28 to 0.31
Diameter of the initial chamber: 0.056 to 0.061

Stratigraphic occurrence

Originally described from Karagandy formation of the USSR, the species has also been reported from lower to middle Tournaisian of Belgium and France. It is restricted to the upper Tournaisian of the central Alborz.

Septabrunsiina krainica (LIPINA), 1948
pl. IV, fig. 6-11

1948. *Endothyra ? krianica* LIPINA, p. 254-255, pl. XIX, fig. 3-6.

1953. *Brunsiina krainica* (LIPINA) - DAIN, p. 29, pl. V, fig. 3-5.

1955. *Septabrunsiina krainica* (LIPINA) - LIPINA, Trad. B.R.G.M., no. 1640, p. 43-44, pl. IV, fig. 12-13.

1961. *Septabrunsiina krainica* LIPINA-ZAV'JALOVA, Trad. I.F.P., p. 6-7, pl. II, fig. 1-3, 6, 9-12.

1962. *Septabrunsiina krainica* (LIPINA) - BOGUSH & JUFEREV, p. 112-113. pl. II, fig. 21.

1966. *Septabrunsiina krainica* (LIPINA) - LIPINA, p. 52, pl. XI, fig. 1-7.

Remarks: this species differs from *Septabrunsiina kingirica* in being smaller in size. Its diameter varies between 0.4 to 0.6 mm. Further it has only 5 to 6 pseudo-chambers in the last volution.

Stratigraphic occurrence

LIPINA described this species from the Tournaisian Cherpet horizon of the Moscow basin. It has also been reported from the

Tournaisian of Donetz and Lvov in the USSR. It is restricted to the upper Tournaisian in the central Alborz.

Genus TOURNAYELLA DAIN, 1953
Tournayella gigantea LIPINA var. *minoris* LIPINA, 1955
pl. VI, fig. 1-3, 8

1955. *Tournayella gigantea* var. *minoris* LIPINA, Trad. B. R. G. M., no. 1640, p. 35, pl. III, fig. 5-6.

1964. *Tournayella gigantea* LIPINA var. *minoris* LIPINA-CONIL & LYS, p. 79, pl. X, fig. 200-202.

1965. *Tournayella gigantea* var. *minoris* LIPINA-LIPINA, p. 30-31, pl. III, fig. 1-5, pl. IV, fig. 1.

Description

Test free, discoidal, planispirally coiled, fairly large, nearly bilaterally symmetrical. It is made up of a spheric initial chamber and a pseudo-tubular second chamber forming 5 whorls. Periphery tending to be lobulate. Umbilicus very large and shallow. Second chamber not consitricted in early stage of growth. Constrictions into pseudo-chambers occur as from the third whorl. Eight to 9 gradually and uniformly in height increasing pseudo-chambers in the last whorl. Wall thick, dark, single-layered and granular, including light-colored grains.

Dimensions

Diameter of test: 0.78 to 1
Breadth of test: 0.25 to 0.32
Thickness of the wall: 0.04 to 0.05

Stratigraphic occurrence

Initially described from the Touranisian Cherpet and Kizel beds of the USSR., it has also been found in the VI of Belgium. In the central Alborz it occurs in the Tn3c to the Vl.

Tournayella moelleri MALAKHOVA, 1954
pl. VI, fig. 4-6, 7, 9

1954. *Tournayella ? moelleri* MALAKHOVA, p. 55, pl. II, fig. 1-2-4.

1955. *Tournayella moelleri* MALAKHOVA-DAIN, Trad. B.R.G.M., no. 1816, p. 31-32, pl. III, fig. 1-5.

1965. *Tournayella moelleri* MALAKHOVA-LIPINA, p. 31-33, pl. IV, fig. 2-7.

Description

Test large for the genus, planispirally coiled, biconcave, and evolute, consisting of a proloculus and a pseudo-tubular second chamber. Peripheral region broadly rounded and weakly lobulate. Umbilicus broad and very deep. Whorls closely coiled, not embracing, and increasing gradually in height but very rapidly in width. Constrictions appear in the later stages of ontogeny, with 6 pseudochambers in the ultimate and penultimate whorls. Wall calcareous, dark, thick, single-layered and containing some hyaline calcite grains.

Dimensions

Diameter of test: 0.7 to 0.9
Breadth of test: 0.4 to 0.5
Thickness of the wall: 0.02 to 0.04

Stratigraphic occurrence

This species was described from the upper Tounaisian Kizel beds of the USSR. It also occurs from the Tn3c to the V1a of the central Alborz.

Tournayella discoidea DAIN forma *maxima* LIPINA, 1955
pl. VII, fig. 1-2

1953. *Tournayella discoidea* DAIN, p. 32-33, pl. III, fig. 17.

1955. *Tournayella discoidea* DAIN forma *maxima*-LIPINA, p. 34, pl. II, fig. 34-36, pl. III, fig. 2.

1961. *Tournayella discoidea* DAIN-ZAV'JALOVA, Trad. I.F.P., p. 5-6, pl. III, fig. 9.

1962. *Tournayella discoidea* DAIN-BOGUSH & JUFEREV, p. 113-114, pl. II, fig. 22-23.

1965. *Tournayella discoidea* DAIN, forma *maxima*-LIPINA, p. 28-29, pl. I, fig. 30-33.

Description

Test medium in size for the genus, planispiral and discoidal. Periphery rounded and slightly lobulate. Initial chamber large and spheric, broader than the pseudo-tubular second chamber, which is increasing gradually in diameter. Number of whorls 5 to 6. Pseudochambers only in the final 2 volutions, the terminal one with 6 pseudo-chambers. Wall calcareous granular.

Dimensions

Diameter of test: 0.6 to 0.7
Breadth of test: 0.2 to 0.21
Ratio of breadth to diameter: 0.3
Daimeter of the initial chamber: 0.07

Stratigraphic occurrence

Tournayella discoidea forma *maxima* has been reported from the Tournaisian Upa and Kizel beds of the USSR. It occurs in the V1a of the central Alborz.

Genus TOURNAYELLINA LIPINA, 1955
Tournayellina (Tournayellina) beata (MALAKHOVA), 1956
pl. VII, fig. 3

1955. *Tournayellina vulgaris* LIPINA-LIPINA, p. 52, pl. V, fig. 21, pl. VI, fig. 1.

1956. *Endothyra? beata* MALAKHOVA, p. 109, pl. IX, fig. 10-12.

1965. *Tournayellina (Tournayellina) beata* (MALAKOVA) - LIPINA, p. 78-79, pl. XVII, fig. 21-23, pl. XVIII, fig. 1-8.

Description

Test spirally coiled, subglobular in shape and consisting of 2 whorls. Coiling planispiral or nearly so. Opening of the spire rather rapid. Last whorl subdivided by constrictions into 4 globular pseudo-chambers. Wall thick, dark and coarsely agglutinated.

Dimensions

Diameter of test: 0.6
Height of the last pseudo-chamber: 0.19 to 0.20
Maximum thickness of the wall: 0.06

Stratigraphic occurrence

Originally described from the Tournaisian Upa to Kizel beds of the USSR. It also occurs in the Vla of the central Alborz.

Tournayellina (Tournayellina) pentacamerata BOZORGNIA, nov. sp.
pl. VII, fig. 9

Derivatio nominis: penta (five) *camera* (chamber).

Holotype: pl. VII, fig. 9.

Locus typicus: Abnak section, upper Jajrud valley.

Stratum typicum: Vla.

Diagnosis: this species of *Tournayellina* is characterized by having 5 chambers in the last whorl and a subquadrangular profile.

Description

Test nearly subquadrangular in oral view, consisting of 1½ to 2 whorls. Five pseudo-chambers in the last volution. Periphery lobulate, sutures distinct and depressed. Pseudo-chambers increasing

gradually in size as added. Wall calcareous, granular with some agglutinated material.

Dimensions

Diameter of test: 0.4
Height of the last chamber: 0.2
Thickness of the wall: 0.04

Remarks: Tournayellina (Tournayellina) pentacamerata is distinguished by its subquadrangular profile and by having 5 pseudo-chambers in the last whorl. It resembles *Tournayellina vulgaris* LIPINA but the latter has a much thicker wall and in the adult more closely coiled volutions.

Stratigraphic occurrence

This species is only found in one sample of the Vla in the Abnak section.

Genus PALEOSPIROPLECTAMMINA LIPINA, 1965
Paleospiroplectammina diversa (N. TCHRNYSHEVA), 1948
pl. V, fig. 1-5, 8

1948. *Paleotextularia diversa* N. TCHERNYSHEVA, p. 248, pl. XVIII, fig. 7-8.

1954. *Paleotextularia diversa* N. TCHERNYSHEVA-GROZDILOVA & LEBEDEVA, p. 75-76, pl. IX, fig. 1.

1965. *Spiroplectammina brevicula* CONIL & LYS, p. 27-28, pl. I, fig. 5-8.

1965. *Paleopiroplectammina diversa* (N. TCHERNYSHEVA) - LIPINA, p. 64-65, pl. XXII, fig. 12-16, pl. XXIII, fig. 1-3.

1968. *Paleospiroplectammina diversa* (N. TCHERNYSHEVA) - CONIL & LYS, pl. IV, fig. 8.

1968. *Paleospiroplectammina diversa* (N. TCHERNYEHEVA) - CONIL & LYS, pl. III, fig. 1.

1970. *Eotextularia diversa* (MALAKHOVA) - GORECKA & MAMET, pl. II, 2-4, plfl III, fig. 1-4.

1970. *Paleospiroplectammina diversa* (N. TCHERNYSHEVA) - LIPINA, pl. II, fig. 8-9.

Description

Test large for the genus, about $1\frac{1}{2}$ as long as broad. Initial portion small consisting of 2 or 3 planispirally arranged pseudo - chambers. Subsequent chambers rectilinear and biserial. The biserial stage composed of three pairs of chambers, which are increasing in breadth and less so in height. Sutures fairly distinct. Septa are as thick as the wall. Wall arenaceous, consisting of a mixture of coarse and fine grains with large amount of cement.

Dimensions

Length of test: 0.4 to 1
Breadth of test: 0.48 to 0.60
Thickness of the wall: 0.06 to 0.07

Stratigraphic occurrence

Upper Tournaisian to lower Visean of the USSR.
Middle Visean of N.W. Cermany.
Lower Visean of S. Poland.
Upper Tournaisian to lower Visean of Belgium.
Tn3c to Vla of the central Alborz.

Paleospiroplectammina mellina (MALAKHOVA) subsp. *claviensis* CONIL & LIPINA, 1970
pl. V, fig. 9

1968. *Paleospiroplectammina mellina* (MALAKHOVA) - CONIL &LYS, pl. III, fig. 36-38.

1968. *Palepspiroplectammina* aff. *mellina* (MALAKHOVA) - CONIL, pl. II, fig. 15.

1970. *Paleospiroplectammina mellina claviensis* CONIL & LIPINA, p. 20-21, pl. I, fig. 5-6.

Description

Test broad, much compressed, early stage planispiral and closely coiled, later stage biserial. Planispiral stage consisting of $1\frac{1}{2}$ to 2

whorls. Four chernyshinelliform and lobulate pseudo-chambers in the last whorl, pseudo-chambers almost equidimensional in biserial portion and increasing moderately in size. Sutures distinct, wall calcareous, granular with some agglutinated material.

Dimensions

Total length of test: 0.6
Maximum breadth of test: 0.4
Diameter of the planispiral portion: 0.2

Stratigraphic occurrence

Vla of Belgium.
Vla of the central Alborz.

Remarks: The present species closely resembles that described and figured by CONIL & LIPINA from Belgium, but it has a larger spiral portion.

Paleospiroplectammina sinensis LIPINA, 1970
pl. V, fig. 10

1970. *Paleospiroplectammina sinensis* LIPINA, p. 19-20, pl. I, fig. 1.

Description

Test small, elongate, subcylindrical or slightly enlarging toward the apertural end. Initial portion consisting of 2 volutions with 4 to 5 pseudo-chambers in the last one. Biserial stage composed of 4 to 5 pairs of inflated chambers. Sutures distinct. Septa long. Wall calcareous, granular and thin.

Dimensions

Total length of test: 0.4 to 0.42
Maximum breadth of test: 0.14 to 0.16
Diameter of the initial portion: 0.14 to 0.15

Maximum thickness of the wall: 0.014

Stratigraphic occurrence

Lower Visean of the USSR.
Vla of the central Alborz.

Paleospiroplectammina guttula (MALAKHOVA), 1954
pl. V, fig. 12

1954. *Spiroplectammina guttula* MALAKHOVA, p. 59-60, pl. I, fig. 17-18.

1954. *Spiroplectammina? guttula* MALAKHOVA - GROZDILOVA & LEBEDEVA, p. 72-73, pl. VIII, fig. 12-13.

1965. *Paleospiroplectammina guttula* (MALAKHOVA) - LIPINA, p. 95, pl. XXIV, fig. 1-6.

Description

Test small for the genus. Initial portion consists of 3 to 4 planispirally coiled pseudo-chambers. Biserial portion composed of 4 paires of inflated chambers. Septa long and as thick as the wall. Sutures distinct. Wall calcareous, granular with some agglutinated material.

Dimensions

Total length of test: 0.31 to 0.36
Maximum breadth of test: 0.2
Maximum thickness of the wall: 0.014

Stratigraphic occurrence

Lower Visean of the USSR.
Vla of the central Alboez

Genus PSEUDOLITUOTUBELLA VDOVENKO, 1967
Pseudolituotubella tenuissima (VDOVENKO), 1954
pl. VII, fig. 5-6, pl. VIII, fig. 2

1954. *Lituotubella tenuissima* VDOVENKO, p. 71-73, pl. III, fig. 2-5.

1967. *Pseudolituotubella tenuissima* (VDOVENKO) - VDOVENKO, p. 27-28, pl. X, fig. 3-4, pl. XI, fig. 5, pl. XII, fig. 1-3.

1968. *Pseudolituotubella tenuissima* (VDOVENKO) - CONIL & LYS, p. 506-507, pl. V, fig. 58-59.

1970. *Pseudolituotubella tenuissima* (VDOVENKO) - VDOVENKO, p. 74, pl. I, fig. 12, pl. II, fig. 3-5.

Description

Test large for the genus, early stage glomospirally coiled, consisting of 3 to 4 whorls with 5 to 6 pseudo-chambers in the last volution, later stage rectilinear with 1 to 3 pseudo-chambers. Sutures distinct. Septa short and massive. Wall agglutinated with much cement.

Dimensions

Total length of test: 1.8 to 1.9
Maximum breadth of the uniserial portion: 0.6 to 0.65
Diameter of the spiral portion: 0.8 to 0.95
Thickness of the wall: 0.075 to 0.08

Stratigraphic occurrence

Lower Visean of the USSR.
Vla-V2a of Belgium.
Vlb of the central Alborz.

Genus MSTINIA MIKHAILOV, 1935
«*Mstinia*» *modavensis* CONIL &LYS, 1967
pl. VIII, fig. 4-5

1967. «*Mstinia*» *modavensis* CONIL & LYS, p. 398-399, pl. II, fig. 10-13.

Description

Test enrolled, large for the genus, in the early stages irregularly coiled, later nearly planispiral. Last whorl strongly increasing in diameter with 4 chernyshinelliform chambers. Periphery lobulate. Septa short and massive. Wall thick, coarsely arenaceous with much cement.

Dimensions

Diameter of test: 0.6 to 0.62
Height of the last chamber: 0.2 to 0.3
Maximum thickness of the wall: 0.042 to 0.045

Stratigraphic occurrence

This species was originally described from transitional beds between Tn3c and Vla of Belgium, it also occurs in the Vla of the central Alborz.

Mstinia sp. 1 CONIL & LYS, 1967
pl. VIII, fig. 1

Description

Test composed of a central glomospirally coiled portion with a diameter of 0.5 mm and an outer portion with more regular coiling. Four to 5 volutions in the adult. Position of axis of coiling varies considerably throughout the whorls. There are 5 rapidly increasing chambers in the final whorl. Septa short and inclined toward the apertural end. Wall agglutinated with finely granular calcite cement.

Dimensions

Diameter of test: 0.93
Height of the last chamber: 0.3
Maximum thickness of the wall: 0.06

Stratigraphic occurrence

Vlb of the central Alborz.

Remarks: only 2 specimens were available. One section shows that sufficient characters for identification are present. This form closely resembles that described by CONIL & LYS as *Mstinia* sp. 1 from the Dinant Synclinorium.

Genus FORSCHIELLA MALAKHOVA, 1935
Forschiella prisca MALAKHOVA, 1939
pl. VIII, fig. 3

1939. *Forschiella prisca* MALAKHOVA, p. 50, pl. II, fig. 3-4.

1953. *Forschiella prisca* MALAKHOVA - DAIN & GROZDILOVA, Trad. B.R.G.M., no. 1816, p. 11, pl. V, fig. 5-6.

1954. *Forschiella prisca* MALAKHOVA - GROZDILOVA & LEBEDEVA, p. 38-39, pl. III, fig. 12.

1956. *Forschiella prisca* MALAKHOVA - GANELINA, Trad. B.R.G.M., no. 1826, p. 10, pl. II, fig. 9.

1964. *Forschiella prisca* MALAKHOVA - CONIL & LYS, p. 71, pl. IX, fig. 159-160.

Description

Test discoidal, and evolute consisting of a relatively small, globular proloculus and a tubular, gradually enlarging deuteroloculus. The second chamber winds for 4 to 5 whorls planispirally and then tends to become rectilinear. The tubular chamber, at least in the last part, is segmented by the constrictions. Wall coarsely agglutinated.

Dimensions

Diameter of test: 1.1
Breadth of test: 0.24
Maximum thickness of the wall: 0.075

Stratigraphic occurrence

This species was described from the upper Visean of the USSR. It has also been reported from the middle to uppr Visean of Belgium and the upper Visean of Holland. It occurs sporadically in the Vlb of the central Alborz.

Family ENDOTHYRIDAE BRADY, 1884
Genus ENDOSPIROPLECTAMMINA LIPINA, 1970
Endospiroplectammina conili LIPINA subsp. *lafoliensis* LIPINA, 1970
pl. V, fig. 6-7, 11

1970. *Endospiroplectammina conili lafoliensis* LIPINA, p. 26, pl. I, fig. 18-19.

Description

Test elongate, cylindrical and slender. Early stages endothyroid and closely coiled, later portion biserially arranged with 5 pairs of chambers. Spiral portion consists of 2 whorls with 4 to 5 chambers in the last volution. Axis of coiling varies considerably in position. Sutures distinct, Chambers inflated. Septa long and as thick as the test wall. Wall calcareous, microgranular.

Dimensions

Total length of test: 0.54 to 0.6
Maximum breadth of test: 0.22
Diameter of the spiral portion: 0.12 to 0.15

Stratigraphic occurrence

Originally described from the Vla of Belgium. It also occurs in the Vla of the central Alborz.

Genus ENDOTHYRA PHILLIPS in BROWN, 1843
sensu BRADY, 1876
Endothyra recta LIPINA, 1955
pl. IX, fig. 3-6

1955. *Endothyra recta* LIPINA, p. 60-61, pl. VII, fig. 4-8.

1964. *Plectogyra recta* (LIPINA) - CONIL & LYS, p. 211, pl. XXXV, fig. 709-710.

1968. *Endothyra recta* LIPINA - CONIL & LYS, pl. IX, fig. 119.

Description

Test relatively large for the genus, discoidal and nearly planispiral. Periphery slightly lobulate. The two inner whorls coiled with slight changes of the axis of coiling. Spire expanding very slowly but uniformly. Number of whorls 4 to 5 with 10 to 11 chambers in the last volution. Septa slightly inclined toward the apertural end. Wall calcareous, finely granular, its thickness varies from 0.01 to 0.012 mm. Supplementary deposits developed in the form of basal nodes.

Dimensions

Diameter of test: 0.39 to 0.55
Height of the last chamber: 0.08 to 0.09

Stratigraphic occurrence

Upper Tournaisian to lower Visean of the USSR.
Vla of Belgium.
It is restricted to and a characteristic form of the Vla in the central Alborz.

Remarks: with exception of the smaller size, this species is identical with the original description given by LIPINA in 1955.

Endothyra paraukrainica LIPINA, 1954
pl. IX, fig. 11-14

1954. *Endothyra paraukrainica* LIPINA, p. 72, pl. XII, fig. 1-4.

1954. *Endothyra paraukrainica* LIPINA - GROZDILOVA & LEBEDEVA, p. 85-86, pl. X, fig. 10-11.

1968. *Endothyra paraukrainica* LIPINA - CONIL & LYS, p. 519. pl. VIII, fig. 97-101.

Description

Test medium-sized for the genus, involute with 3 to 3½ whorls. Chambers very slightly convex. Periphery rounded, slightly lobulate. Number of chambers in final whorl usually 5 to 6. Chambers increase gradually in size. Plane of coiling of the last whorl nearly perpendicular to the plane of the penultimate one. Sutures depressed. Septa long and curved toward the apertural end. Wall calcareous, microgranular. Supplementary deposits very well developed, in the form of high, narrow ridges, curved in the direction of the aperture.

Dimensions

Diameter of test: 0.4 to 0.45
Thickness of the wall: 0.011

Remarks: in most of its characters, such as the regular expansion of the last whorl, the deviation of the axis of coiling throughout the test and the strong hook-like basal deposits the present form is identical with *Endothyra paraukrainica*. A complete comparison cannot be made because LIPINA illustrated only a vertical section.

Stratigraphic occurrence

Upper Tournaisian, Kizel of the USSR.
Tn2c to V1a of Belgium.
V1a of the central Alborz.

Endothyra laxa (CONIL & LYS), 1964
pl. IX, fig. 8-10, 15

1964. *Plectogyra laxa* CONIL & LYS,, p. 193, pl. XXXI, fig. 610-612.

1968. *Endothyra laxa* (CONIL & LYS) - CONIL & LYS, pl. VI, fig. 26.

Description

Test small to medium in size for the genus with 3 to 3½ whorls. Spire expanding very rapidly and uniformly with growth. Periphery lobulate, chambers convex. Plane of coiling of the last volution usually almost perpendicular to plane of the penultimate whorl. There are 5 to 6 chambers in the last whorl. Septa short and inclined forward. Wall thin and finely granular with maximum thickness of about 0.01 mm.

Dimensions

Diameter of test: 0.3 to 0.48
Height of the last chamber: 0.1 to 0.15

Stratigraphic occurrence

V1a to V2a of Belgium.
V1a of the central Alborz.

Endothyra inflata LIPINA forma *maxima*, 1955
pl. IX, fig. 7

1955. *Endothyra inflata* forma *maxima* LIPINA, Trad. B.R.G.M., no. 1640, p. 59, pl. VI, fig. 7-10.

Description

Test medium in size for the genus, nearly involute with 3 to 5 whorls and somewhat compressed laterally. Periphery not lobulate. The axis of coiling changing in position in the early stages. Last whorls coiled planispirally. Chambers longer than high and slightly convex. Nine to 11 chambers in the last whorl and 7 to 9 in the penultimate one. Chambers increasing very gradually in size. Septa straight and slightly inclined forward. Wall calcareous and finely granular.

Dimensions

Diameter of test: 0.38 to 0.40

Breadth of test: 0.15 to 0.18

Stratigraphic occurrence

Upper Tournaisian of the USSR.
V1a to V2b of the central Alborz.

Endothyra stricta (CONIL & LYS), 1964
pl. X, fig. 1-11

1964. *Plectogyra rotayi* (LEBEDEVA) var. *stricta* CONIL & LYS, p. 213, pl. XXXVI, fig. 719-721.

1968. *Endothyra* aff. *recta* LIPINA-CONIL & LYS, p. 521, pl. VII, fig. 88-89.

Description

Test relatively large for the genus with 4 to 6 whorls. Axis of coiling changes in position throughout enrollment. Periphery lobulate. Last whorl with 11 to 15 chambers. Initial chamber small and spheric, its diameter ranges from 0.028 to 0. 035 mm. Chambers increasing gradually in size. Sutures slightly depressed. Septa short and slightly inclined forward. Wall calcareous, finely granular. Supplementary deposits distinct, thin, hook-shaped and inclined in the direction of coiling.

Dimensions

Diameter of test: 0.5 to 0.8
Height of the last chamber: 0.1 to 0.2

Stratigraphic occurrence

V1a to V1b of Belgium.
V1a of the central Alborz.

Remarks: It is here proposed to consider CONIL & LYS var. *stricta* as a distinct species, because its irregular enrollment is much denser than that of *Endothyra rotayi*. Further its secondary deposits are

stronger developed. There is a certain similarity between *Endothyra stricta* and *Endothyra honesta* SCHLYKOVA, 1962, pl. V, fig. 1. But since the holotype of *Endothyra honesta* is an axial section and the equatorial section passes obliquely through the ultimate whorl, it is impossible to observe the form of the supplementary deposits. *Endothyra honesta* shows thicker septa and more irregular chambers than *Endothyra stricta*. *Endothyra stricta* is similar to *Endothyra recta* LIPINA, but differs by its oscillating type of coiling and by higher chambers in the last whorl.

Endothyra apposita GANELINA, 1956
pl. XVIII, fig. 1-5, 7

1956. *Endothyra apposita* GANELINA, p. 89, pl. VI, fgi. 7-8.

1964. *Plectogyra apposita* (GANELINA) - CONIL & LYS, p. 165, pl. XXIV, fig. 464-469.

1967. *Endothyra scabra* CONIL & LYS, p. 407, pl. IV, fig. 43.

1968. *Endothyra apposita* GANELINA - CONIL & LYS, p. 516, pl. VI, fig. 67-68.

1969. *Endothyra apposita* GANELINA - DVORAK & CONIL, pl. III, fig. 37.

Description

Test large for the genus, consisting of 3 to 4 volutions. Periphery lobulate. Axis of coiling changes in position throughout the enrollment. The last whorl almost perpendicular to the penultimate one. Chambers inflated, with 6 to 7 in the lats whorl. Spire expanding slowly in the inner whorls but very rapidly in the last one. Septa short and slightly inclined in the direction of coiling. Wall finely granular and relatively thick. Supplementary deposits in the form of nodes and terminal spines occur in the last volution. Diameter of test varies between 0.5 to 0.75 mm.

Stratigraphic occurrence

Upper Visean of the USSR.
V2a to V3a of Belgium.
V2a to V2b of the central Alborz.

Endothyra bradyi MIKHAILOV, 1939
pl. XVIII, fig. 6

1876. *Endothyra bowmani* PHILLIPS-BRADY, p. 92-93, pl. V, fig. 4.

1939. *Endothyra bradyi* MIKHAILOV,, p. 51-52, pl. IV, fig. 1-2.

1964. *Plectogyra bradyi* (MIKHAILOV)- CONIL & LYS, p. 167-171, pl. XXIV, fig. 473-483, pl. XXV, fig. 484-498.

Description

Test medium in size for the genus with 2½ to 3 whorls, nearly planispirally coiled with a slight degree of axial rotation in the central whorls. Last whorl with 7 to 8 chambers. Chambers moderately inflated, broader than high, gradually and uniformly increasing in size. Septal face nearly perpendicular to the outer wall or very slightly inclined forward. Wall dark, finely granular. Supplementary deposits well developed, covering the inner surface of the last whorl and producing node-like thickening in the midportion of each chamber. Diameter of test varies from 0.5 to 0.54 mm.

Stratigraphic occurrence

Upper Visean of England.
Upper Visean to Baschkirian of the USSR.
Upper Tournaisian to upper Visean of Belgium.
Lower Visean of Egypt.
V1b to V2b of the central Alborz.

Endothyra acantha (CONIL & LYS), 1964
pl. XVIII, fig. 9-10

1964. *Plectogyra acantha* CONIL & LYS, p. 163-164, pl. XXIII, fig. 450-453.

Description

Test small for the genus, consisting of 2½ to 3 whorls. Axis of coiling varies markedly in position from whorl to whorl. Angle between the planes of coiling of the ultimate and penultimate whorls attains about 70°. Six chambers in the last whorl. Chambers inflated gradually increasing in size. Sutures depressed. Septa long, arcuate and extending toward the apertural face. Wall thin and finely granular, its thickness is about 0.012 mm. Supplementary deposits in the form of high spine-shaped nodes, located between adjacent septa and curving toward the apertural end. Diameter of test varies from 0.35 to 0.38 mm.

Stratigraphic occurrence

V1b to V3b of Belgium.
V1b to V2b of the central Alborz.

Remarks: the present species differs from its closest relative *Endothyra hirsuta* by its more irregular coiling and by fewer chambers in the last whorl. It differs from *Endothyra kentuckyensis* by its more pointed and higher nodosities.

Endothyra sp. cf. *E. spira* (CONIL & LYS), 1964
pl. XVIII, fig. 11-12

1964. *Plectogyra spira* CONIL & LYS, p. 220, pl. XXXVII, fig. 750-752.

Description

Test small for the genus, consisting of 2 or 2½ whorls. Central portion endothyroid, the last 1½ whorls coiled planispirally. Seven chambers in the last volution. Chambers uniformly inflated and separated by rather deep sutures. Septa long slightly curved in the direction of coiling. Wall finely granular. Supplementary deposits distinct. In the last 2 whorls they cover the inner surface of the whorls and produce nodosities.

Remarks: except for the lack of the hook-shaped supplementary deposits, that may have been destroyed by the recrytalization, our specimens are very similar to *Endothyra spira*.

Stratigraphic occurrence

V3a to V3b of Belgium.

V2b of the central Alborz.

Endothyra convexa BAUZER-CHERNOUSSOVA subsp. *exelikta* CONIL & LYS, 1964
pl. XIX, fig. 3-5, 6, 8

1964. *Plectogyra exelikta* var. *exelikta* CONIL & LYS, p. 184, pl. XXVIII, fig. 555-563.

1968. *Endothyra exelikta* var. *exelikta* (CONIL & LYS) - CONIL & LYS, pl. VI, fig. 25.

1968. *Endothyra convexa* BAUZER-CHERNOUSSOVA subsp. *exelikta* CONIL & LYS-CONIL & LYS, p. 516.

1969. *Endothyra exelikta exelikta* (CONIL & LYS) - DVORAK & CONIL, pl. II, fig. 33.

Description

Test large for the genus, with 2½ whorls. Central portion endothyroid, the final 1½ whorls nearly planispiral. Periphery lobulate. Chambers convex, with 5 to 6 in the last whorl. Sutures depressed. Septa as thick as the wall and inclined in the direction of coiling. Chambers increasing gradually in height in the central portion, but very rapidly in the last whorl. Wall calcareous, granular and thick. Diameter of test varies from 0.4 to 0.6 mm.

Stratigraphic occurrence

V2b to V3b of Belgium.
V3 of NW Germany.
V2 to V3 of Moravie.
V1b to V2a of the central Alborz.

Endothyra sp. aff. *E. tuberculata* LIPINA
pl. XVIII, fig. 10-11, pl. XIX, fig. 9

Description

Test medium in size for the genus consisting of 3 to 4 whorls. Axis of coiling changes markedly in position from whorl to whorl.

Chambers slightly lobulate, 6 to 6½ in the last whorl.. Septa curved and slightly inclined forward. Sutures distinct. Wall calcareous granular, supplementary deposits occur in the form of tubercles situated on the inner surface of the whorls. Diameter of the test 0.4 to 0.45 mm.

Remarks: the only 3 specimens encountered differ from *Endothyra rugosa* by a fewer number of chambers in the last whorl and by much thinner septa. They are better related to *Endothyra tuberculata* for the development of the supplementary deposits, the manner of coiling and the number of chambers in the final volution. The limited number of the specimens does not permit to decide whether the supplementary deposits are high or low. However, specimens with rounded protuberances have been identified as *Endothyra tuberculata* by GROZDILOVA & LEBEDEVA, 1954, pl. X, fig. 7, LEBEDEVA, 1954, pl. III, fig. 1, and MALAKHOVA, 1956, pl. X, fig. 1-6.

Stratigraphic occurrence

V2a of the central Alborz, only one specimen similar to this species has been found in the lowermost Visean of Belgium.

Endothyra omphalota RAUZER - CHERNOUSSOVA & REITLINGER var. *minima* RAUZER - CHERNOUSSOVA & REITLINGER, 1936
pl. XXI, fig. 1,3

1936. *Endothyra omphalota* var. *minima* RAUZER - CHERNOUSSOVA & REITLINGER, p. 210-211, text-fig. 5.

1954. *Endothyra omphalota* RAUZER - CHERNOUSSOVA & REITLINGER var.*minima* RAUZER - CHERNOUSSOVA & REITLINGER - GROZDILOVA & LEBEDEVA, p. 100, pl. XII, fig. 10-11.

1964. *Plectogyra omphalota* (RAUZER - CHERNOUSSOVA & REITLINGER) var. *minima* RAUZER - CHERNOUSSOVA & REITLINGER - CONIL & LYS, p. 198, pl. XXXII, fig. 635-642, pl. XXXIII, fig. 643-645.

1967. *Plectogyra omphalota* (RAUZER - CHERNOUSSOVA & REITLINGER) var. *minima* RAUZER - CHERNOUSSOVA & REITLINGER - CONIL & LYS, pl. IV, fig. 41-42.

Description

Test large for the genus with 3 whorls in the adult, completely involute and slightly compressed laterally. Periphery broadly rounded. Number of chambers in the final whorl 8. Sutures undistinct or very slightly depressed. The plane of coiling in the early whorls sharply changes its position. Wall calcareous, finely granular and thick. Supplementary deposits well developed.

Dimensions

Diameter of test: 0.75 to 0.84
Maximum breadth of test: 0.45 to 0.50J
Maximum thickness of the wall: 0.06

Stratigraphic occurrence

Upper Visean, Tula-Venev of the USSR.
V2b to V3b of Belgium.
V3a of the central Alborz.

Endothyra omphalota RAUZER - CHERNOUSSOVA & REITLINGER var. *parvula* BOZORGNIA, nov. var.
pl. XXI, fig. 2,4,6-9

Derivatio niminis: parvula, very small.
Holotype: pl. XXI, fig. 4.
Locus typicus: Gaduk section, NE of Firuz-Kuh.
Stratum typicum: V2b.
Diagnosis: a variety of *Endothyra omphalota* distinguished by its smaller size and by having fewer number of chambers in the last volution.

Description

Test spirally coiled, completely involute consisting of 3 to 4 whorls. Periphery rounded and slightly lobulate. Plane of coiling highly variable throughout the enrollment. Number of chambers in

the final whorl 7 to 8. Chambers slightly inflated. Initial chamber relatively large and spheric, measuring from 0.05 and 0.07 mm across. Septa curved, and slightly inclined forward. Their thicknesses equal to the test wall or even slightly thicker. Wall dark and finely granular. Supplementary deposits well developed, covering the inner surface of the last whorl and producing a relatively high ridge between the 2 adjacent septa.

Dimensions

Diameter of test: 0.43 to 0.63
Maximum breadth of test: 0.3 to 0.32

Remarks: this variety differs from *Endothyra omphalota* var. *minima* by its much smaller size and by fewer chambers in the ultimate and penultimate whorls.

Stratigraphic occurrence

V2b of the central Alborz.

Endothyra convexa RAUZER - CHERNOUSSOVA subsp. *regularis* RAUZER - CHERNOUSSOVA, 1948
pl. XXI, fig. 10-11

1948. *Endothyra convexa* var. *regularis* RAUZER - CHERNOUSSOVA, p. 169, pl. IV, fig. 11-12.

Description

Test spirally coiled, consisting of 2½ to 3 whorls. Chambers convex, 6 to 7 in the last whorl, central portion endothyroid but the last 1 and 1½ whorls coiled planispirally. Expansion of spire rather rapid. Sutures indistinct and very slightly depressed. Septa thick, short and slightly inclined in the direction of coiling. Wall calcareous, granular and thick.

Dimensions

Diameter of test: 0.5 to 0.62

Height of the last chamber: 0.18 to 0.21
Maximum thickness of the wall: 0.04

Remarks: this subspecies differs from *Endothyra convexa* for its more regular coiling and by more chambers in the last whorl. It differs *from Endothyra convexa exelikta* for the smaller enlargement of the chambers of the last whorl, and also for the more regular coiling in this portion of the test.

Stratigraphic occurrence

This species was initially described from middle Visean, Oka beds of the USSR. It also occurs in the V2a to V3a of the central Alborz.

Genus DAINELLA BRADZHNIKOVA, 1962
Dainella chomatica (DAIN) forma *typica* BRADZHNIKOVA, 1962
pl. IX, fig. 16-18

1962. *Dainella chomatica* (DAIN) forma *typica* - BRADZHNIKOVA, p. 23-24, pl. X, figfl 9, pl. XI, fig. 1-4.

1964. *Dainella chomatica* (DAIN) forma *typica* BRADZHNIKOVA - CONIL & LYS, p. 149, pl. XXI, fig. 429.

1967. *Dainella chomatica* (DAIN) forma *typica* BRADZHNIKOVA - CONIL & LYS, pl. II, fig. 17.

Description

Test small for the genus, ovoid, completely involute, consisting of 4 to 4½ whorls. Axis of coiling changes its position in each whorl as much as 90° with respect to the axis of the preceding whorl. Periphery broadly rounded. There are 10 to 12 chambers in the penultimate whorl. Chambers increasing very gradually in size. Septa short and slightly inclined forward. Wall calcareous and finely granular. Basal deposits in the form of chomata are present

Dimensions

Diameter of test: 0.4 to 0.45
Breadth of test: 0.28 to 0.3

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of Belgium
V1a of the central Alborz

Dainella chomatica (DAIN) forma *magna* BRADZHNIKOVA, 1962
pl. XI, fig. 1-2

1962. *Dainella chomatica* (DAIN) forma *magna* - BRADZNIKOVA, p. 24-25, pl. XI, fig. 4, 7-8.

Description

Test large for the genus, involute, laterally compressed and consisting of 4½ to 5 whorls. Periphery rounded. Plane of coiling changes markedly throughout the enrollment, angle between the axix of coiling in adjacent whorls about 75°. Last volution with 12 to 13 chambers. Chambers gradually increasing in the central portion of the test, but very rapidly in the last whorl. Sutures slightly depressed. Septa short, and slightly thicker than the wall. Wall finely granular. Basal deposits in the form of chamata present in all the whorls.

Dimensions

Diameter of test: 0.62 to 0.7
Maximum breadth of test: 0.33 to 0.35

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of the central Alborz.

Dainella chomatica (DAIN) forma *staffelloides*
BRADZHNIKOVA, 1962
pl. XI, fig. 13-15

1962. *Dainella chomatica* (DAIN) forma *staffelloides* - BRADZHNIKOVA, pl. XI, fig. 5-6, 9.

Description

Test small for the genus, subspheric to suboval, completely involute, consisting of 3½ to 4½ volutions. The axis of coiling varies strongly in position from whorl to whorl. Septa short and much thicker than the test wall. Wall relatively thin and finely granular. Chomata present in all the whorls.

Dimensions

Diameter of test: 0.33 to 0.40
Breadth of test: 0.30 to 0.31

Remarks: this from differs from *Dainella chomatica* forma *typica* by its smaller size and more spherical shape of the test.

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of the central Alborz.

Dainella elegantula forma *typica* BRADZHNIKOVA, 1962
pl. XI, fig. 9-10, 12

1962. *Dainella elegantula* forma *typica* - BRADZHNIKOVA, p. 25-26, pl. XII, fig. 1-4, 7.

Description

Test medium in size for the genus, subspheric, inner whorls completely involute, last whorl partially evolute, periphery broadly rounded. Coiling irregular with abrupt changes in the planes of coiling, angle between the axis of coiling in 2 adjacent whorls ranges from about 60° to 80°. Last spire expands rapidly. Counting of chambers is difficult since the sections usually have an irregular form due to abrupt changes in the position of the axis of coiling. Penultimate whorl with about 11 chambers. Septa thick and perpendicular to the wall. Wall finely granular. Chomata well developed in all the whorls.

Dimensions

Diameter of test: 0.41 to 0.51
Height of the last spire: 0.1 to 0.12

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of the central Alborz.

Dainella densaspira BOZORGNIA, nov. sp.
pl. XI, fig. 7-8

Derivatio nominis: densa, close, dense; *spira,* coiled.
Holotype: pl. XI, fig. 7.
Locus typicus: Gaduk section, NE of Firuz-Kuh.
Stratum typicum: V1a.
Diagnosis: Test closely coiled, periphery broadly rounded; axis of coiling variable from whorl to whorl, but changing slightly in position.

Description

Test medium-sized for the genus with 5 to 5½ whorls, subspheric to ovoid, and completely involute. Periphery broadly rounded. Thirteen to 15 chambers in the last volution. Chambers almost as broad as high, and producing a slightly lobulate peripheral outline. Axis of coiling changes its position from whorl to whorl. The angle from whorl to whorl does not exceed 35° to 50°. The last 1½ whorls coiled in a single plane. Septa thicker than the wall and perpendicular to it. Spire expanding gradually and uniformly throughout the whorls. Wall finely granular. Chomata weakly developed.

Dimensions

Diameter of test: 0.59 to 0.63
Maximum breadth of test: 0.34 to 0.36
Height of the last chamber: 0.09 to 0.1
Diameter of the initial chamber: 0.03

Remarks: the present species differs from its closest relative *Dainella elegantula* by being completely involute, tightly coiled and by the slowly increasing height of chambers in the last volution.

Stratigraphic occurrence

V1a of the central Alborz.

Dainella alborzensis BOZORGNIA, nov. sp.
pl. XI, fig. 3-6

Derivation nominis: Alborz Mountains situated in N Iran.
Holotype: pl. XI, fig. 4.
Locus typicus: Gaduk section, NE of Firuz-Kuh.

Diagnosis: test subspheric to ovoid; axis of coiling varies considerably in position in the central portion; but less so in the last 1½ to 2 whorls; septa very thick.

Description

Test spirally coiled, involute with 4 to 5 whorls. In the last whorl the coiling may deviate to one side, and then from the opposite side the preceding whorl is visible. Axis of coiling highly variable in position in central portion, but the last 1½ to 2 whorls nearly in the same plane. Initial chamber relatively large and spheric, its diameter varies from 0.33 to 0.04 mm. Eleven to 12 chambers in the last volution. Spire narrowly enrolled in the inner portion and expanding rapidly in the last 1½ to 2 whorls. Septa much thicker than the test wall. Wall finely granular. Chomata well developed.

Dimensions

Diameter of test: 0.48 to 0.6
Breadth of test: 0.32 to 0.45
Height of the last whorl: 0.1 to 0.12

Remarks: this species is related to *Dainella densaspira.* However, it

is easily distinguished by fewer number of whorls and also by the less number of the chambers per volutions. Further the septa and the chomata are thicker.

Stratigraphic occurrence

V1a of the central Alborz.

Dainella elegantula forma *ventrosa* BRADZHNIKOVA, 1962
pl. XI, fig. 11

1962. *Dainella elegantula* forma *ventrosa* BRADZHNIKOVA, P, 26-27 pl. XII, fig. 5-6, 8-10

Description

Test medium-sized for the genus, asymmetrical, with usually 4 whorls. Axial rotation of the whorl produces small, shallow umbilical depression on one side and involute enrollment on the opposite side. Axis of coiling varies considerably in position throughout the test. Spire expanding moderately in central portion, but rapidly in the last whorl. Wall finely granular. Chomata well developed in all the whorls.

Dimensions

Diameter of test: 0.5
Breadth of test: 0.33

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of the central Alborz (very rare).

Dainella tumultuosa BOZORGNIA, nov. sp.
pl. XII, fig. 6-12

Derivatio nominis: tumultuosus; disquieting, turbulent.
Holotype: pl. XII, fig. 8.

Locus typicus: Gaduk section, NE of Firuz-Kuh.
Stratum typicum: V1a.
Diagnosis: test spirally coiled; asymmetrical; partially evolute; axis of coiling deviates in position as much as 45°; wall coarsely granular and light-colored; chomata well developed.

Description

Test of medium dimensions for the genus with 4 to 4½ whorls, involute or partially evolute. Axis of coiling of the whorls, and even the individual chambers, variable in position. Initial chamber measures 0.07 mm. Chambers are higher than long. Fourteen to 15 chambers in the final whorl. Spire expanding gradually throughout the test. Septa nearly perpendicular to the wall. Wall coarsely granular and light-colored. Chomata well developed and cone-shaped.

Dimensions

Diameter of test: 0.5 to 0.63
Breadth of test: 0.3 to 0.4

Remarks: Dainella tumultuosa differs from the all known dainellas and it certainly represents a new toxon. Important criteria used for the errection of this species are 1, structure of the wall, which is not finely granular and 2, each chamber is displaced in respect to the preceding one.

Stratigraphic occurrence
V1a of the central Alborz.

Dainella exuberans (CONIL & LYS), 1964
pl. XII, fig. 1

1964. *Plectogyra? exuberans* CONIL & LYS, p. 185-186, pl. XXIX, fig. 564-567.

Description

Test medium in size for the genus, consisting of 5 to 5½ whorls.

Axis of coiling changes in position markedly in the initial portion, but less so in the last 1½ to 2 whorls. Chambers as high as long and increasing very slowly in size in the central portion, but rapidly in the last whorl with 12 chambers. Septa thicker than the test wall and inclined in the direction of coiling.

Dimensions

Diameter of test: 0.59 to 0.63
Breadth of test: 0.4 to 0.43

Stratigraphic occurrence

V2a of Belgium.
V1a of the central Alborz.

Dainella fleronensis (CONIL & LYS), 1964
pl. XII, fig. 2-3

1964. *Plectogyra? fleronensis* CONIL & LYS, p. 186-187, pl. XXIX, fig. 569-574.

Description

Test small for the genus, partially evolute and consisting of 4 to 4½ volutions. Axis of coiling changes abruptly in position throughout the enrollment. Spire tightly coiled in central area. Chambers increasing gradually in size in the early portion, but enlarge very rapidly in the last 1½ whorls. Septa short, thick and inclined forward.

Dimensions

Diameter of test: 0.38 to 0.42
Breadth of test: 0.3 to 0.31

Stratigraphic occurrence

V1a to V2a of Belgium.
V1a of the central Alborz.

Dainella sp. cf. *D. fleronensis* (CONIL & LYS), 1964
pl. XII, fig. 4-5

Remarks: the present form resembles but differs from *Dainella fleronensis* in having fewer chambers in the central whorls.

Stratigraphic occurrence

V1a of the central Alborz.

Genus LYSELLA BOZORGNIA, nov. gen.

Type species: Lysella gadukensis
Derivatio nominis: this genus is named for Mr. M. Lys University of paris, for his contributions to the knowledge of Paleozoic foraminifera.

Diagnosis of the genus: test free, lenticular, small to large in size, almost or entirely involute, consisting of 4 to 7 volutions, with numerous chambers in each whorl. Early 2 to 3 whorls characterized by endothyroid coiling, final whorls coiled planispirally. Apertural face inflated with low lunate interiomarginal-equatorial aperture. Wall calcareous, finely granular, dark or light-colored. Supplementary deposits in the form of chomata.

Remarks: Lysella may be easily confused with highly developed upper Visean *Eostaffella*. However, the developed endothyroid stage of *Lysella* distinguishes it from *Eostaffella*. Furthermore, the first evolutionary appearance of *Lysella* is in strata, where the representatives of the *Fusulinidae* are still in a primitive stage of evolution. It seems likely that *Lysella* is a quasi homeomorph of the *Eostaffellas*, and it is suggested that it arose from *Dainella* since all of its species show in the early stage an irregular enrollment.

Lysella gadukensis BOZORGNIA, nov. sp.
pl. XIV, fig. 5-7

Derivatio nominis: Gaduk; a small village in the Firuz-Kuh area.

Holotype: pl. XIV, fig. 5.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: this species of *Lysella* is characterized by the abrupt changes of the plane of coiling in the central portion and by having convex and spacious chambers in the final whorl.

Description

Test spirally coiled with 5 to 6 whorls, laterally compressed showing a shallow and broad umbilicus. Periphery broadly rounded. Chambers inflated. Ratio of greatest axial and equatorial diameter equals 0.63 to 0.65. Axis of coiling varies markedly in position in the early 3 to 3½ volutions. Last 2 to 3 whorls planispirally coiled. Twelve to 13 chambers in the final whorl. Sutures depressed. Septa nearly perpendicular to the wall or slightly inclined in the direction of coiling. Chambers increasing gradually in size as added. Wall dark, finely granular. Supplementary deposits in the form of chomata.

Dimensions

Diameter of test: 0.67 to 0.71
Breadth of test: 0.31 to 0.33

Stratigraphic occurrence

V1a to V1b of the central Alborz.

Lysella umbilicata BOZORGNIA, nov. sp.
pl. XII, fig. 13-16

Derivatio nominis: umbilicus; the navel.

Holotype: pl. XII, fig. 15.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: a species of *Lysella* characterized by its umbilical depressions, its general outline of the test, and by very strong chomata.

Description

Test of medium dimension for the genus, completely involute with 4 to 4½ whorls, biumblicate, and entirely symmetrical in axial view. Peripheral margin broadly rounded. Fourteen to 16 chambers in the last whorl. Axis of coiling of the central portion changes its position in each whorl. Final 2½ whorls coiled in the same plane. Initial chamber relatively large and spheric. Its diameter attains about 0.04 mm. Subsequent chambers subquadrangular, higher than broad and increasing gradually in size as added. Septa perpendicular to the wall and slightly thickened at the apertural ends. Wall calcareous, yellowish, consisting of minute crystals of calcite bounded by microgranular cement. Strong chomata in all whorls.

Dimensions

Diameter of test: 0.51 to 0.6
Maximum breadth of test: 0.31 to 0.35
Height of the last whorl: 0.11 to 0.12
Ratio of maximum breadth to diameter: 0.62 to 0.66

Remarks: Lysella umbilicata with its planispiral final coiling is derived from *Dainella tumultuosa*.

Stratigraphic occurrence

V1a of the central Alborz.

Lysella crassisepta BOZORGNIA, nov. sp.
pl. XIII, fig. 1-6

Derivatio nominis: crassus; thick, solid.

Holotype: pl. XIII, fig. 3.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: characterized by its large size, small early endothyroid portion, and thick septa.

Description

Test large for the genus, entirely involute with 6 to 7 whorls, biumbilicate, almost symmetrical in axial view with slight changes in the positions of the axis of coiling in the early 2½ to 3 whorls. Umbilical cavities broad. Peripheral margin rounded. Sixteen to 18 chambers in the last whorl. Initial chamber measures 0.05 to 0.55 mm. Subsequent chambers broader than high and increasing gradually in size as added. Septa much thicker than the wall and inclined in the direction of coiling. Wall calcareous, finely granular, and dark. Chomata weakly developed.

Dimensions

Diameter of test: 0.61 to 0.8
Height of the last whorl: 0.08 to 0.11
Breadth of test: 0.36 to 0.41
Ratio of maximum breadth to diameter: 0.52 to 0.54

Remarks: this species differs from *Lysella gadukensis*, nov. sp., by its larger size, more numerous whorls, more chambers in the last whorl, and by a smaller early endothyroid portion.

Stratigraphic occurrence

V1a to V1b of the central Alborz.

Lysella schubertelloides BOZORGNIA, nov. sp.
pl. XIII, fig. 7-13

Derivatio nominis: refers to its similarity with *Schubertella*.

Holotype: pl. XIII, fig. 7.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: this species of *Lysella* is characterized by its smaller size, and fairly well developed chomata.

Description

Test free, nearly lenticular, involute with 5 to 6 whorls, biumbilicate. Peripheral region broadly rounded. Umbilici wide and shallow. Axis of coiling changes its position in the early 2 to 2½ whorls. Fourteen to 16 chambers in the final whorl. Initial chamber attains 0.05 to 0.054 mm. It is large in relation to the size of test. Chambers almost as high as long and increasing gradually in size as added. Septa short, thick and inclined in dircetion of enrollment. Very strong chomata in all whorls.

Dimensions

Diameter of test: 0.47 to 0.58
Breadth of test: 0.3 to 0.34
Height of the last chamber: 0.047 to 0.85
Maximum thickness of the septa: 0.035
Ratio of maximum breadth to diameter: 0.6 to 0.63

Remarks: Lysella schubertelloides differs from *Lysella crassisepta*, nov. sp., by its smaller size, its fewer chambers in the last volution and by having strong chomata. It differs from *Lysella conferta*, nov. sp., by its less close coiling and its thicker septa.

Stratigraphic occurrence

V1a to V1b of the central Alborz.

Lysella multicamerata BOZORGNIA, nov. sp.
pl. XIV, fig. 1-2

Derivatio nominis: multicamerata; having many chambers.

Holotype: pl. XIV, fig. 1.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: this species of *Lysella* is characterized by its large size, and by having many chambers in each volution.

Description

Test large, entirely involute with 6 to 6½ whorls, slightly compresed laterally, biumbilicate, in axial view, almost bilaterally symmetrical, nearly circular in peripheral outline. Umblical cavity wide and shallow. Early 1½ to 2 whorls coiled in different planes. Twenty subquadrangular chambers in the final whorls. Chambers usually longer than high, and gradually enlarging in size. Sutures slightly depressed. Septa as thick as the test wall and slightly inclined forward. Wall dark, thick and finely granular. Chomata occur in all whorls.

Dimensions

Diameter of test: 0.78 to 0.8
Breadth of test: 0.4
Thickness of the wall: 0.017 to 0.018
Ratio of maximum breadth to diameter: 0.5

Remarks: Lysella multicamerata, nov. sp. differs from *Lysella crassisepta* nov. sp., its closest relative, by its greater number of chambers in each whorl and by thinner septa.

Stratigraphic occurrence

V1b of the central Alborz.

Lysella scitula BOZORGNIA, nov. sp.
pl. XIV, fig. 3-4

Derivatio nominis: scitula; pretty, elegant.

Holotype: pl. XIV, fig. 4.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: characterized by having subquadrangular chambers, and fewer chambers in the final volution.

Description

Test of medim size for the genus, consisting of 5½ to 6 volution, with some degree of rotation of the axis of coiling in the first 2 to 2½ whorls. Fourteen to 16 chambers in the final whorl. Initial chamber large and spheric, its diameter attains 0.055 mm. Subsequent chambers nearly subquadratic or slightly convex, except for the last chamber, which often shows a constriction. Spire expanding slowly with growth. Sutures slightly depressed. Septa nearly perpendicular to and as thick as the wall. Wall calcareous, dark, finely granular. Supplementary deposit not observed.

Dimensions

Height of the penultimate chamber: 0.1 to 0.12
Diameter of test: 0.62 to 0.65
Maximum thickness of the wall: 0.012

Remarks: specimens of this species are rare. No axial sections have been noticed among the material. However, some of the morphological criteria of the equatorial section separates it from the other described species of *Lysella,* hence it is advisable to consider *Lysella scitula,* nov. sp., as a distinct species of the genus. It differs from *Lysella tumultuosa,* nov. sp., by its finely granular wall structure, and by more numerous volutions. It differs from *Lysella schubertelloides* by its larger size and by thinner septa.

Stratigraphic occurrence

V1a of the central Alborz.

Lysella conferta BOZORGNIA, nov. sp.
pl. XIV, fig. 8-13

Derivatio nominis: confertus; dense.

Holotype: pl. XIV, fig. 8.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: this species of *Lysella* is characterized by its closely coiled enrollment, its more strongly developed endothyroid early portion and its thinner wall and septa.

Description

Test of medium size for the genus with 6 to 7 whorls, lenticular, closely coiled, slightly compressed laterally. Endothyroid portion composed of 2½ to 3 whorls with well defined changes in the positions of the axis of coiling. Number of chambers in the last whorl 13 to 14. Initial chamber measures 0.03 mm. Chambers convex and longer than high. Sutures distinct. Septa short, curved in direction of coiling, forming an obtuse angle with the wall. Wall dark, finely granular. Chomata well developed.

Dimensions

Diameter of test: 0.53 to 0.58
Breadth of test: 0.28 to 0.32
Maximum height of the last whorl: 0.082 to 0.1
Ratio of maximum breadth to diameter: 0.51 to 0.54
Maximum thickness of the wall: 0.014

Remarks: Lysella conferta, nov. sp., closely resembles *Lysella schubertelloides,* nov. sp., but it differs from the latter by its larger size, its more densely coiled enrollment, and its much thinner septa.

Stratigraphic occurrence

V1a to V1b of the central Alborz.

Lysella mediocriformis BOZORGNIA, nov. sp.
pl. XV, fig. 1-4

Derivatio nominis: refers to its similarity with *Mediocris.*

Holotype: pl. XV, fig. 2.

Locus typicus: Gaduk section, NE of Firuz-Kuh.

Stratum typicum: V1a.

Diagnosis: this species of *Lysella* is characterized by its small size, and the few whorls.

Description

Test very small for the genus, lenticular with 3 to 4 whorls, biumbilicate, peripheral margin broadly rounded. Umbilical cavities shallow and wide. Axis of coiling changes its position in the first 1½ to 2 volutions. Initial chamber measures 0.042 mm. Subsequent chambers subquadratic and increasing gradually in size as added. Number of chambers in the final whorl 11 to 12. Septa thick and al-

most perpendicular to the wall. Wall dark, finely granular. Chomata in all whorls.

Dimensions

Diameter of test: 0.37 to 0.43
Breadth of test: 0.18 to 0.24
Height of the last volution: 0.05 to 0.07
Ratio of maximum breadth to diameter: 0.49 to 0.55

Remarks: Lysella mediocriformis is easily distinguished from all other species of *Lysella* by its smaller size, fewer whorls and fewer chambers in the final whorl.

Stratigraphic occurrence

V1a of the central Alborz.

Genus NEOENDOTHYRA REITLINGER, 1965

Neoendothyra reicheli REITLINGER, 1965
pl. XXXVIII, fig. 2, 4-9, pl. XXXIX, fig. 3-4

1965. *Neondothyra reicheli* REILLINGER, p. 61-62, pl. I, fig. 6-9.

Description

Test large, lenticular, planispiral, involute consisting of 1½ to 3 volutions. Periphery subacute with flat to slightly convex umbilicus. Spire expanding gradually and uniformly during ontogeny. Number of chambers in the outer whorl 8 to 9. Septa long, slightly inclined forward. Wall calcareous, irregularly granular. Well developed basal supplementary deposits and umbilical fillings.

Dimensions

Diameter of test: 0.6 to 0.84

Breadth of test: 0.35 to 0.41
Ratio maximum breadth to diameter: 0.42 to 0.56

Stratigraphic occurrence

Lower Trias, Induan of the Julfa Region, USSR.
Upper Murghabian, upper part of the Ruteh formation of the central Alborz.

Neoendothyra broennimanni BOZORGNIA, nov. sp.
pl. XXXVIII, fig. 1, 3, 10

1965. *Neoendothyra* sp. no. 2 REITLINGER, pl. I, fig. 4-5

Derivatio nominis: this species is named for Mr. P. Broennimann, University of Geneva, for his contributions to micropaleontology.

Holotype: pl. XXXVIII, fg. 1.

Locus typicus: Aruh section, Firuz-Kuh area.

Stratum typicum: Upper Murghabian, upper part of the Ruteh formation.

Diagnosis: characterized by its large size, oscillating type of coiling, relatively deep umbilical depressions and numerous chambers in the final whorl.

Description

Test large for the genus, partially involute and biumbilicate, consisting of 3 volutions with 11 chambers in the final one. Periphery broadly rounded. Umbilical depressions relatively deep. Outline in equatorial view slightly lobulate. Plane of coiling changing in position throughout the enrollment. Spire expanding gradually with growth. Septa long, forming an almost perpendicular angle with the wall. Wall calcareous and finely granular. Well developed basal supplementary deposits in equatorial and axial sections. Umbilical filling present.

Dimensions

Diameter of test: 0.8 to 1
Breadth of test: 0.5 to 0.54
Ratio of maximum breadth to diameter: 0.54 to 0.56

Remarks: the present species differs from *Neoendothyra reicheli* by being larger in size, having more chambers in the final whorl, and by showing an oscillating type of coiling.

Stratigraphic occurrence

Upper Murghabian, upper part of the Ruteh formation to lower Nessen formation of the central Alborz.

* *Neoendothyra parva* (LANGE), 1925
pl. XXXIX, fig. 1, 2, 5

1925. *Nummulostegina? parva* LANGE, p. 272, pl. IV, fig. 79a only.

1965. *Neoendothyra parva* (LANGE) - REITLINGER, pl. I, fig. 1.

1965. *Neoendothyra* sp. no. 1, REITLINGER, pl. I, fig. 2-3.

Description

Test small, lenticular and involute, consisting of 2½ volutions. Periphery narrowly rounded. Initial chamber globular and relatively large. Number of chambers in the final whorl 7 or 7½. Chambers subquadratic in equatorial view, slightly convex and increasing rapidly in size. Plane of coiling changes slightly in the early stage. Wall calcareous and irregularly granular. Basal supplementary deposits well developed.

Dimensions

Diameter of test: 0.41 to 0.57
Breadth of test: 0.23 to 0.50
Ratio of maximum breadth of diameter: 0.51 to 0.78
Diameter of the initial chamber: 0.07

Remarks: LANG'S thin sections were examined by the writer. From the illustrated figures given by LANGE as *Nummulostegina? parva,* the figure 79a is definitly a *Neoendothyra.* The equatorial section of fig. 79b is certainly from a fusulinid-type foraminifera which most probably belongs to *Codonofusiella.* Forms similar to *Neoendothyra parva* are sporadically found in the upper Murghabian of the central Alborz. REITLINGER accepted the specimen illustrated by fig. 79b of LANGE as a true *Neoendothyra parva.* According to her description *Neoendothyra reicheli* has fewer chambers in the last whorl in comparison with *Neoendothyra parva. Neoendothyra parva* differs from *Neoendothyra reicheli* by its smaller size, fewer chambers in the last whorl and slight deviation of the axis of coiling in the central portion.

Stratigraphic occurrence

Middle Permian of Sumatra.
Upper Guadalupian, Gnishiks horizon of Transcaucasian territory.
Upper Murghabian of the central Alborz.

Subfamily BRADYININAE REITLINGER, 1950

Genus BRADYINA MOELLER, 1878

Bradyina lucida MOROZOVA, 1949

pl. XXIX, fig. 3

1949. *Bradyina lucida* MOROZOVA, Trad. B.R.G.M., no. 783, p. 9, pl. III, fig. 1, 2, 4.

Description

Test of medium dimension for the genus, subspheric and consisting of 2 to 2½ whorls with 5 chambers in the last volution. Proloculus large and subglobular with a diameter of about 0.12 mm. Subsequent chambers longer than high, slightly convex and increasing very rapidly in size. Septa thin, long and curved forward. Preseptal lamellae thin, long and diverging from the septa at an obtuse angle.

Wall calcareous, microgranular, and perforate with distinct radial lamellae.

Dimensions

Diameter of test: 1.2 to 1.4
Height of the penultimate chamber: 0.48
Thickness of the wall: 0.12

Stratigraphic occurrence

Lower Permian of the USSR.
V3b of the central Alborz.

Family TETRATAXIDAE GALLOWAY, 1933

Genus TETRATAXIS EHRENBERG, 1843

Tetrataxis conica EHRENBERG, 1854
pl. XVI, fig. 2

1854. *Tetrataxis conica* EHRENBERG, p. 24, pl. XXXVII, fig. 12.

1879. *Tetrataxis conica* EHRENBERG - MOELLER, p. 71, pl. II, fig. 3a-g, pl. VII, fig. 1-2.

1930. *Tetrataxis conica* EHRENBERG - CUSHMAN & WATERS, p. 75, pl. VII, fig. 2a-b, 4.

1932. *Tetrataxis conica* EHRENBERG - LIEBUS, p. 163, pl. IX, fig. 29, 32.

1965. *Tetrataxis conica* EHRENBERG - PREMOLI SILVA, p. 108-109, pl. XVI, fig. 4.

Description

Test conical, of medium dimensions for the genus, consisting of 6 whorls with an apex angle of about 75°. Sides nearly straight. Umblilical wide. Chamber sometimes divided into chamberlets. Wall double-layered and relatively thick, the hyaline layer poorly developed.

Dimensions

Diameter of test: 0.7 to 0.8
Height of test: 0.50 to 0.55
Maximum thickness of the wall: 0.04

Stratigraphic occurrence

V1a to Lower Permian of the central Alborz.

Tetrataxis hemispherica MOROZOVA, 1949
pl. XVI, fig. 1

1949. *Tetrataxis hemispheria* MOROZOVA, Trad. B.R.G.M., no. 783, p. 15. pl. I, fig. 12, 17, 18.

Description

Test large for the genus, hemispherical, consisting of 5 to 6 whorls. Apex angle about 90°. Sides convex. Umbilicus rather wide. Chambers crescentic and increasing gradually in size. Wall calcareous and double-layered, showing a well developed hyaline, radial layer at the basal part of the chambers.

Dimensions

Diameter of test: 1.2 to 1.4
Height of test: 0.5 to 0.6

Stratigraphic occurrence

Lower Permian, Tastub of the USSR.
V1b and lower Murghabian of the central Alborz.

Tetrataxis hemispherica var. *elongata* MOROZOVA, 1949
pl. XVI, fig. 3.

1949. *Tetrataxis hemisphaerica* var. *elongata*, MOROZOVA, pl. XVI, fig. 3.

1958. *Tetrataxis hemisphaerica* var. *elongata* MOROZOVA - LYS & SERRE,

pl. V, fig. 5.

1962. *Tetrataxis hemisphaerica* var. *elongata* MOROZOVA - POTIEVSKAIA, p. 64, pl. IV, fig. 4.

Description

Test of medium size for the genus, and subconical, consisting of 7 to 8 whorls. Height almost equal to width. Apex angle about 70°. Sides nearly straight, tending to become slightly convex in the terminal part. Apex rounded. Umbilical region almost flat to slightly convex. Wall calcareous, granular, containing some agglutinated elements.

Dimensions

Diameter of test: 0.8
Height of test: 0.82

Stratigraphic occurrence

Lower Permian (Tastub) of the USSR.
Westphalian of Spain.
V1a and lower Murghabian of the central Alborz.

Tetrataxis planulata MOROZOVA, 1949
pl. XVI, fig. 4

1949. *Tetrataxis planulata* MOROZOVA, Trad. B.R.G.M., no. 783, p. 21, pl. I, fig. II.

Description

Test large for the genus, low conical, consisting of 5 to 6 whorls. Sides slightly convex. Umbilicus deep and wide. The apex angle varies from 110° to 120°. Chambers increasing gradually in size as added. Septa as thick as the wall. Wall calcareous and finely granular with an outer radial layer at the basal part of each chamber.

Dimensions

Diameter of test: 1.1 to 1.2

Height of test: 0.40 to 0.44

Stratigraphic occurrence

Lower Permian (Tastub) of the USSR.
V1a of the central Alborz.

Genus VALVULINELLA SCHUBERT, 1907
Valvulinella youngi (BRADY), 1876
pl. XXIX, fig. 1, 2

1876. *Valvulina youngi* BRADY, p. 86, pl. IV, fig. 6, 8, 9.

1968. *Valvulinella youngi* (BRADY) - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVI, fig. 4.

Description

Test conical, consisting of 6 to 7 trochospirally arranged volutions, with irregular sides and concave umbilical region. Chambers subdivided into numerous chamberlets. Apex angle about 60° to 70°. Wall calcareous finely granular.

Dimensions

Height of test: 0.35 to 0.36
Diameter of test: 0.41

Stratigraphic occurrence

Lower Carboniferous of England.
Middle Visean of the USSR.
V2b of the central Alborz.

Family AMMODISCIDAE RHUMBLER, 1895
Genus BRUNSIA MIKHAILOV, 1939
Brunsia spirillinoides (GROZDILOVA & GLEBOVSKAIA), 1948
pl. VII, fig. 10

1948. *Glomospira spirillinoides* GROZDILOVA & GLEBOVSKAIA, p. 147, pl. I, fig. 2-4.

1954. *Brunsia? spirillinoides* (GROZDILOVA & GLEBOVSKAIA) - GROZDILOVA & LEBEDEVA, p. 30, pl. III, fig. 6-7.

1955. *Glomospirella irregularis* (MOELLER) - LIPINA, p. 30, pl. II, fig. 27-30.

1964. *Glomospirella spirillinoides* var. *spirillinoides* (GROZDILOVA & GLEBOVSKAIA) - CONIL & LYS, p. 65-66, pl. VIII, fig. 145-149.

1968. *Glomospirella spirillinoides* (GROZDILOVA & GLEBOVSKAIA) - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVII, fig. 20.

1969. *Brunsia spirillinoides* (GROZDILOVA & GLEBOVSKAIA) - DVORAK & CONIL, pl. I, fig. 6.

Description

Test discoidal, evolute in the adult, biconcave, with rounded periphery, consisting of 8 volutions. Small initial portion consisting of 3 to 4 glomospirally arranged whorls. Between early glomospiral and later planispiral coiling a short biserial portion is present. Lumina crescent-shaped increasing gradually and uniformly in size with growth. Wall calcareous, finely granular and thin.

Dimensions

Diameter of test: 0.50 to 0.65
Breadth of test: 0.09 to 0.13

Stratigraphic occurrence

Upper Tournaisian to lower Visean of the USSR.
Visean of Belgium.
V1b of the central Alborz (very rare).

Brunsia pulchra (MIKHAILOV), 1939
pl. VII, fig. 11

1939. *Brunsia pulchra* MIKHAILOV - not seen

1948. *Brunsia pulchra* MIKHAILOV - RAUZER - CHERNOUSSOVA, p. 241, pl. III, fig. 2-4.

1948. *Brunsia pulchra* MIKHAILOV - GROZDILOVA & GLEBOVSKAIA, p. 148, pl. I, fig. 5-6.

1954. *Brunsia? irregularis* MIKHAILOV - GROZDILOVA & LEBEDEVA, p. 30, pl. III, fig. 2-4.

1955. *Glomospirella pseudopulchra* LIPINA, pp. 31-32, pl. II, fig. 25, 31.

1964. *Glomospirella pseudopulchra* LIPINA - CONIL & LYS, p. 65, pl. VIII, fig. 137-144.

Description

Test discoidal, evolute in the adult, with 7 whorls and nearly planoparallel sides. Periphery broadly rounded. Initial portion coiled irregularly and raised in a point above the surface of the test, later portion planispiral. Wall calcareous, finely granular and relatively thick.

Dimensions

Diameter of test: 0.6 to 0.62
Maximum breadth of test: 0.2
Diameter of the initial portion: 0.17

Remarks: this species differs from *Brunsia spirillinoides* by the thicker wall and an initial portion which is raised above the surface of the test.

Stratigraphic occurrence

Upper Tournaisian to upper Visean of the USSR.
Visean of Belgium.
V1b of the central Alborz.

Family ARCHAEDISCIDAE CUSHMAN, 1928
Genus ARCHAEDISCUS BRADY, 1873

Remarks: In contrast to most authors we consider the family *Archaediscidae* monogeneric. We are recognizing within the only genus

Archaediscus 7 subgenera which are all distinguished by a double - layered wall. The usage of subgeneric taxa, as we understand it, is perfectly justified by the facts that: 1) each subgenus represents in the evolution of the group a distinct morphologic stage and 2) each subgenus possesses a certain time significance. All of the stratigraphically successive subgenera are linked by the transitional forms, hence the limits between the individual subgenera as well as the limits between the subgenerically characterized time intervals cannot be clearly defined.

We maintain the subgenus *Paraarchaediscus* and distinguish it from *Permodiscus*. However, *Paraarchaediscus* may be a junior synonym of *Permodiscus*. In fact, the co-occurrence with the same population of the completely planispiral *Permodiscus* with in the early stage irregular coiled *Paraarchaediscus* suggests that this synonymy should most probably be accepted. The fact that in both forms morphologic characters apart from the enrollment are identical leads us to believe that *Permodiscus* is nothing but the spirally completely polarized form of *Paraarchaediscus* and may represent the megalospheric and *Paraarchaediscus* the microspheric representative of one and the same species. Should this be the case *Paraarchaediscus* can no longer be maintained.

As far as the enrollment of the archaediscids is concerned this feature shows a distinct morphologic parallelisme between the type of coiling found in the Traissic and early Jurassic *Involutinidae* (Koehn-Zaninetti, 1967). This would suggest that also in the *Archaediscidae* the type of enrollment is a character of secondary taxonomic significance only usable for the definition of species and infraspecies taxa.

The sigmoidal type of coiling of the deuteroloculus which has not been observed in the enrollment of the involutinids, occurs commonly in the archaediscids. Similar to the planispiral enrollment also this type of coiling is considered to be completely polarized. However, in some instance the sigmoidal enrollment is followed by a very short planispiral final coiling hence the sigmoidal enrollment could also be interpreted as being not yet completely polarized. All

the types of enrollment i.e. oscillating, oscillating-planispiral, sigmoidal, irregular-sigmoidal, completely planispiral and sigmoidal - planispiral may occur associated in the same population at all stratigraphic levels.

Apart from the morphologic parallelisme between the involutinids and the archaediscids this would be another reason not to consider the type of coiling as taxonomic important. On the other hand subgeneric criteria are: first the thickness of the individual layers of the wall, second the development of nodosities and rugosities of the hyaline layer and third the reduction of the lumen of the deuteroloculus.

The stratigraphic older subgenera *Paraarchaediscus* and *Permodiscus,* V1b to V3, possess a wall consisting of thick hyaline and microgranular layers, no nodular development of the hyaline layer and a large deuterolocular lumen.

The stratigraphically following subgenus *Archaediscus,* VIb to Baschkirian shows a thicker hyaline layer and a comparatively thin microgranular layer, no nodular structures and a fairly large deterolocular lumen.

The next stratigraphically younger subgenus *Rugosoarchaediscus,* V2b to Baschkirian is diffined by a very thin microgranular layer and comparatively thick and nodular hyaline layer. The nodular rugosities protrude into the lumen of the deuteroloculus which therefore is being reduced.

The stratigraphically next younger subgenus *Neoarchaediscus,* V3a to Baschkirian, shows a double-layered wall where the microgranular is either very reduced or absent. The hyaline layer in contrast is thick, develops strong nodosities, and the lumen of the deuteroloculus becomes strongly reduced.

The youngest subgenus *Asteroarchaediscus,* V3c to lower Moscovian has a wall in which the microgranular layer is virtually absent, the nodosities are strong and protrude in such a way into the

lumen of the deuteroloculus that the latter becomes almost completely closed. This is the end-stage of the evolutionary development of the *Archaediscidae.*

From a biological point of view, this end-stage reached such a degree in the reduction of the lumen of the deuteroloculus that it cannot contain viable quantities of protoplasma. The evolution of the *Archaediscidae* represents one of the rare instances among the foraminifera where, clearly, the incompatibility between environment and organisme did not result in the extinction, but the morphologic development of the test alone was responsible for its disappearance.

Within the archaediscids we find the first clear indication for the evolutionary relationships between a double-layered wall and an almost single-layered hyaline wall. This evolutionary series would support the idea that the single-layered hyaline wall developed from a more primitive double-layered stock.

Genus ARCHAEDISCUS BRADY, 1973
Subgenus PARAARCHAEDISCUS ORLOVA, 1955
Archaediscus (Paraarchaediscus) rigens (CONIL & LYS), 1964
pl. XV, fig. 8

1964. *Propermodiscus rigens* CONIL & LYS, p. 135-136, pl. XX, fig. 408-410.

1968. *Paraarchaediscus rigens* (CONIL & LYS) - CONIL & LYS, p. 513-514, pl. XI, fig. 136. 138.

Description

Test medium-sized for the genus, lenticular with flattened sides and rounded periphery. Initial chamber spheric and up to 0.035 mm in maximum diameter. Undivided second chamber produces 5 whorls. The first 3 whorls are slighly oscillating and the final 2 planispirally coiled. Lumina are in axial section broader than high and increasing gradually in size with growth. Wall double-layered. Outer hyaline layer in the polar region thick, thinner toward the periphery of the test and nearly disappearing at the periphery of the last whorl. Inner, microgranular layer dark-colored, thick throughout the test and

thickening toward the lateral basal parts of the chamber lumina.

Dimensions

Diameter of test: 0.3 to 0.32
Breadth of test: 0.12 to 0.13
Ratio of maximum breadth to diameter: 0.39 to 0.40

Stratigraphic occurrence

V1b to V2 of Belgium
V1b to V2a of the central Alborz.

Archaediscus (Paraarchaediscus) lenitortus (CONIL & LYS), 1964
pl. XV, fig. 11

1964. *Propermodiscus lenitortus* CONIL & LYS, p. 134, pl. XX, fig. 402.

Description

Test large for the genus, lenticular with rounded periphery and convex lateral sides. Initial chamber measures 0.035 mm. Tubular second chamber produces 4 to 5 volutions. Axis of coiling in the first 2 whorls changing in position, later whorls planispirally coiled. Lumen of deuteroloculus large, as high as broad. Wall thick and double - layered. Outer layer very thick in polar region, thinner toward the periphery and almost disappearing in the last whorl. Inner, dark layer well developed and thicker at the basal lateral corners of the lumina.

Dimensions

Diameter of test: 0.48
Breadth of test: 0.25
Ratio of maximum breadth to diameter: 0.5

Stratigraphic occurrence

V1b of Belgium

V1b of the central Alborz.

Archaediscus (Paraarchaediscus) mixtus (CONIL & LYS), 1964
pl. XV, fig. 10, pl. XVII, fig. 2

1964. *Propermodiscus mixtus* CONIL & LYS, p. 134-135, pl. XX, fig. 403-404.

Description

Test relatively large, lenticular, with slightly convex lateral sides and rounded periphery. Initial chamber not seen. Deuteroloculus making 4 to 5 volutions. Coiling oscillating in the major portion of the test and nearly planispiral in the final 1½ to 2 whorls. Lumina slightly broader than high. Wall double-layered. Inner layer well developed with a distinct thickening at the basal corners of the lumina. Outer layer thick in the polar region and thinner towrd the periphery of the test.

Dimensions

Diameter of test: 0.42 to 0.5
Breadth of test: 0.18 to 0.25
Ratio of maximum breadth to diameter: 0.43 to 0.53

Stratigraphic occurrence

V1b to V3 of Belgium
V1b to V2b of the central Alborz.

Archaediscus (Paraarchaediscus) preconvexus BOZORGNIA, nov. sp.
pl. XVII, fig. 1

Derivatio nominis: refers to its evolutionary appearence before *Archaediscus convexus.*

Holotype: pl. XVII, fig. 1.
Locus typicus: Abnak section, upper Jajrud valley.

Stratum typicum: V1b.
Diagnoisis: characterized by its sigmoidal coiling of the deuteroloculus, and by the great thickness of its outer hyaline layer throughout the test.

Description

Test inflated, lenticular, with 4½ to 5 whorls, periphery broadly rounded, sides convex. Coiling of deuteroloculus sigmoidal as seen in axial section. Lumina much broader than high and increasing rapidly in size. Wall double-layered. Outer hyaline layer thick. Inner dark layer well developed and very thick in basal corners of the lumina.

Dimensions

Diameter of test: 0.38
Breadth of test: 0.26
Height of the last lumen: 0.67
Ratio of maximum breadth to diameter: 0.67

Remarks: the present species differs from *Paraarchaediscus miloni* by its sigmoidal enrollment and the thick, hayline outer layer of the wall.

Stratigraphic occurrence

V1b of the central Alborz.

Archaediscus (Paraarchaediscus) miloni (PELHAT), 1967
pl. XVII, fig. 3

1967. *Propermodiscus miloni* PELHAT, p. 898, pl. XXXII, fig. 5-6.

Description

Test lenticular with rounded periphery and convex sides, consisting of 4 to 5 whorls. Axis of coiling oscillating throughout the whorls. Lumina increasing rapidly in size. Wall thick and double -

layered, the inner dark and finely granular layer fills the lateral portion of the lumina, outer layer thick, especially around the umbilical region .

Dimensions

Diameter of test: 0.45 to 0.51
Breadth of test: 0.25
Ratio of maximum breadth to diameter: 0.55

Stratigraphic occurrence

V1b to V2b of France
V1b to V2b of Belgium.
V1b to V2a of the central Alborz.

Subgenus PERMODISCUS DUTKEVITCH, 1948
Archaediscus (Permodiscus) rotundus (N. CHERNYSHEVA) var. *inflatus* CONIL & LYS, 1964
pl. XV, fig. 9, 12

1964. *Permodiscus rotundus* N. CHERNYSHEVA var. *inflata* CONIL & LYS, p. 132, pl. XX, fig. 396-397.

Description

Test lenticular, oval in axial view and involute. In equatorial section with convex lateral sides and rounded periphery. Initial chamber measures up to 0.028 mm. Tubular second chamber forms 4 to 5 planispiral volutions. Lumina of deuteroloculus are much broader than high and increasing gradually in size. Wall double-layered. Inner layer dark and finely granular, thicker toward the basal corners of the lumina. Outer layer very thick in polar region and thin toward the periphery of the test.

Dimensions

Diameter of test: 0.33 to 0.36
Breadth of test: 0.2 to 0.22

Ratio of maximum breadth to diameter: 0.54 to 0.65

Remarks: it is noteworthy that the subgenus *Permodiscus* has never been encountered in the Permian sediments. *Nummulostegina padangensis* LANGE, the only «*Permodiscus*» reported so far from the Permian is in fact a *Hemigordius*.

Stratigraphic occurrence

V1b to V2a of Belgium.
V1b to V2a of the central Alborz.

Archaediscus (Permodiscus) rotundus (N. CHERNYSHEVA) var. *elongatus* CONIL & LYS, 1964
pl. XV, fig. 13

1964. *Permodiscus rotundus* N. CHERNYSHEVA var. *elongata* CONIL & LYS, p. 131-132, pl. XX, fig. 394-395.

Remarks: this variety differs from *Archaediscus (Permodiscus) rotundus inflatus* by its smaller size, parallel lateral sides, and smaller ratio of breadth to diameter.

Stratigraphic occurrence

V1b to V2a of Belgium.
V1b to V2a of the central Alborz.

Archaediscus (Permodiscus) abnakensis BOZORGNIA, nov. sp.
pl. XVII, fig. 4-5

Derivatio nominis: Abnak, nearest village to the type locality.
Holotype: Pl. XVII, fig. 4.
Locus typicus: Abnak section, upper Jajrud valley.
Stratum typicum: V1b.

Diagnosis: characterized by its large size, numerous volutions and the nearly discoidal shape of its test.

Description

Test very large for the genus, almost discoidal, lateral sides parallel or very slightly convex. Diameter of initial chamber from 0.028 to 0.035 mm. Second chamber produces 5 to 6 volutions. Last whorl often evolute. Lumina increasing rapidly in size with growth. Inner layer of wall very well developed, outer layer in the periphery thin.

Dimensions

Diameter of test: 0.51 to 0.60
Breadth of test: 0.16 to 0.17
Ratio of maximum breadth to diameter: 0.29 to 0.33
Height of the last lumen: 0.08 to 0.1

Remarks: the numerous whorls, strong development of the inner layer of the wall, large diameter of test and smaller ratio of breadth to diameter differentiate this species from all other described forms of the subgenus *Permodiscus*.

Stratigraphic occurrence

V1b of the central Alborz.

Subgenus PLANOARCHAEDISCUS MIKLUKO - MAKLAY, 1955
Archaediscus (Planoarchaediscus) eospirillinoides BRADZHNIKOVA, 1967
pl. XVII, fig. 7-8

1948. *Archaediscus spirillinoides* RAUZER - CHERNOUSSOVA - CHERNYSHEVA, pl. II, fig. 7-8.

1953. *Archaediscus spirillinoides* RAUZER - CHERNOUSSOVA - GROZDILOVA, Trad. B.R.G.M., no. 1816, p. 112-113, pl. IV, fig. 17.

1964. *Planoarchaediscus spirillinoides* (RAUZER - CHERNOUSSOVA) - CONIL & LYS, pl. XX, fig. 399-400.

1967. *Planoarchaediscus eospirillinoides* BRADZHNIKOVA, p. 164-165, pl. X, fig. 10, pl. LI, fig. 7-9, 12-13.

1968. *Planoarchaediscus eospirillinoides* BRADZHNIKOVA - AISENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVII, fig. 15, 18.

1968. *Planoarchaediscus eospirillinoides* BRADZHNIKOVA - CONIL & LYS, p. 514-515, pl. XI, fig. 145-146.

Description

Test discoidal with 5 to 6 whorls, involute except for the last 2 whorls, periphery rounded. Axis of coiling in the first 2 to 3 whorls changes slightly in position, but last whorls coiled planispirally. Outer hyaline layer very reduced, only present in the polar regions. Last 2 whorls do not possess hyaline layer, but inner layer very well developed.

Dimensions

Diameter of test: 0.36 to 0.40
Breadth of test: 0.08 to 0.10
Ratio of maximum breadth to diameter: 0.23 to 0.26

Stratigraphic occurrence

Lower to upper Visean of the USSR.
V3b of Belgium.
V2b of the central Alborz.

Archaediscus (Archaediscus) stilus GROZDILOVA & LEBEDEVA, 1953
pl. XVII, fig. 6, pl. XIX, fig. 11-13, pl. XXII, fig. 7

1953. *Archaediscus stilus* GROZDILOVA & LEBEDEVA, Trad. B.R.G.M. no. 1816, p. 113-114. pl. IV. 19-20.

1954. *Archaediscus stilus* GROZDILOVA & LEBEDEVA - GROZDILOVA & LEBEDEVA, p. 61-62, pl. VII, fig. 19.

1962. *Archaediscus krestovnikovi* RAUZER-CHERNOUSSOVA - BOGUSH & JUFEREV, pl. IX, fig. 10.

1964. *Archaediscus krestovnikovi* var. *krestovnikovi* RAUZER - CHSRNOUSSOVA - CONIL & LYS, pl. XVII, fig. 345-351.

Description

Test medium-sized for the genus, involute except for the last whorl. Periphery rounded. Diameter of initial chamber about 0.043 mm. Deuteroloculus produces 5 to 6 volutions. In final 2 whorls they are almost planispiral and slightly oscillating. Lumina almost as high as broad and increasing gradually in size with growth. Inner microgranular layer thin. Outer hyaline layer very thin in peripheral region and thicker toward the lateral sides of the test.

Dimensions

Diameter of test: 0.37 to 0.45
Breadth of test: 0.14 to 0.17
Ratio of maximum breadth to diameter: 0.31 to 0.40 J

Stratigraphic occurrence

Visean to Baschkirian of the USSR.
V2a to V3a of the central Alborz.

Archaediscus (Archaediscus) macer CONIL & LYS, 1964
pl. XXIV, fig. 16, 22

1964. *Archaediscus macer* CONIL & LYS, p. 123, pl. XVIII, fig. 361-362.

Description

Test small for the genus, involute except for the last whorl, with truncated periphery. Globular initial chamber with a diameter of 0.042 mm. Second chamber produces 4 volutions with sigmoidal enrollment. Lumina broader than high and increasing gradually with growth. Wall thin, inner layer weakly developed.

Dimensions

Diameter of test: 0.18 to 0.23
Breadth of test: 0.1 to 0.14

Ratio of maximum breadth to diameter: 0.56 to 0.62

Stratigraphic occurrence

V3c of Belgium.
V3b of the central Alborz.

Archaediscus (Archaediscus) moelleri RAUZER - CHERNOUSSOVA, 1948
pl. XXII, fig. 1

1948. *Archaediscus moelleri* RAUZER - CHERNOUSSOVA, p. 231, pl. XV, fig. 14-15.

1953. *Archaediscus moelleri moelleri* RAUZER - CHERNOUSSOVA - GROZDILOVA, Trad. B.R.G.M., no. 1816, p. 81-82, pl. I, fig. 15-18.

1954. *Archaediscus moelleri* RAUZER - CHERNOUSSOVA - GROZDILOVA & LEBEDEVA, p. 47, pl. V, fig. 6.

1962. *Archaediscus moelleri* RAUZER - CHERNOUSSOVA, - BOGUSH & JUFEREV, p. 201-202, pl. IX, fig. 5.

1964. *Archaediscus moelleri* var. *moelleri* RAUZER - CHERNOUSSOVA - CONIL & LYS, p. 124-125, pl. XIX, fig. 370.

1968. *Archaediscus moelleri* RAUZER - CHERNOUSSOVA - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVII, fig. 416.

Description

Test large for the genus, lenticular, oval in axial section. Periphery rounded. Diameter of initial chamber 0.43 mm. Deuteroloculus produces 4 to 5 volutions in sigmoidal arrangement. Lumina much broader than high and increasing gradually in size with growth. Inner microgranular layer strongly reduced but outer hyaline layer well developed.

Dimensions

Diameter of test: 0.43 to 0.47
Height of the last lumen: 0.065 to 0.07 J

Stratigraphic occurrence

Upper Visean (Tula) to Namurian (Protva) of the USSR.
V3b of Belgium.
V3b of the central Alborz.

Archaediscus (Archaediscus) crux CONIL & LYS, 1964
pl. XXII, fig. 2

1964. *Archaediscus crux* CONIL & LYS, p. 110, pl. XV, fig. 286. 288.

Description

Test large for the genus, involute except for the last whorl, inflated and lenticular with strongly convex lateral sides and narrowly rounded periphery. Initial chamber small. Deuteroloculus produces 6 volutions. Plane of coiling changes its position about 60° in every 2 volutions. This regular changing of the plane of coiling is the diagnostic feature of the species, It results a cross-type arrangement in axial view. Lumina increasing gradually and uniformly in size with growth.

Dimensions

Diameter of test: 0.5
Breadth of test: 0.33

Stratigraphic occurrence

V3 of Belgium.
V3b of the central Alborz.

Archaediscus (Archaediscus) krestovnikovi var. *krestovnikovi* RAUZER - CHERNOUSSOVA, 1948
pl. XXII, fig. 3-4

1948. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA, p. 10, pl. II, fig. 18-20.

1953. *Archaediscus krestovnikovi* var. *krestovnikovi* RAUZER - CHERNOUSSOVA - GROZDILOVA, Trad. B.R.G.M., no. 1816, p. 94, pl. II, fig. 17-19.

1954. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA, - GROZDILOVA & LEBEDEVA, p. 56-57, pl. VII, fig. 2-3.

1962. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA - BOGUSH & JUFEREV, p. 202-203, pl. IX, fig. 7-8.

1964. *Archaediscus koktjubensis* RAUZER - CHERNOUSSOVA - CONIL & LYS, pl. XVII, fig. 338-340.

1968. *Archaediscus krestovnikovi* subsp. *krestovnikovi* RAUZER - CHERNOUSSOVA - CONIL & LYS, pl. XI, fig. 153-154.

1969. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA - CONIL & LYS, pl. II, fig. 23-24.

Description

Test medium-sized for the genus, involute except for the last 2 whorls. Arrangement of enrollment is sigmoidal which in the last 2 volutions changes into planispiral. Periphery broadly rounded. Diameter of initial 0.036 to 0.042 mm. Second chamber produces 5 to 6 whorls. Inner dark layer of the wall thin. Outer hyaline layer well developed.

Dimensions

Diameter of test: 0.37 to 0.41
Breadth of test: 0.2 to 0.22
Ratio of maximum breadth to diameter: 0.52 to 0.53
Height of the last lument: 0.064 to 0.071

Stratigraphic occurrence

Visean of USSR.
V1b to V3 of Belgium.
V2b to V3a of the central Alborz.

Archaediscus (Archaediscus) pulvinus CONIL & LYS, 1964
pl. XXIII, fig. 1-3

1964. *Archaediscus pulvinus* CONIL & LYS, p. 126, pl. XIX, fig. 373-375.

Description

Test large for the genus, inflated and lenticular with convex lateral sides and rounded periphery. Deuteroloculus produces 5 whorls. Enrollment oscillating in the early portion, it changes into planispiral in the last 2 volutions. Lumina increasing gradually in height and rapidly in breadth. Inner dark layer well developed. Outer hyaline layer, especially in the central portion of the lateral sides very thick.

Dimensions

Diameter of test: 0.37 to 0.50
Breadth of test: 0.20 to 0.27
Ratio of maximum breadth to diameter: 0.54 to 0.55

Stratigraphic occurrence

V2b to V3a of Belgium.
V2b to V3a of the central Alborz.

Archaediscus (Archaediscus) moelleri RAUZER - CHERNOUSSOVA var. *gigas* RAUZER - CHERNOUSSOVA, 1948
pl. XXIII, fig. 4-6

1948. *Archaediscus moelleri* var. *gigas* RAUZER - CHERNOUSSOVA, p. 232, pl. XV, fig. 16-18, pl. XVI, fig. 1.

1953. *Archaediscus moelleri* var. *gigias* RAUZER - CHERNOUSSOVA, - GROZDILOVA, Trad. B.R.G.M., no. 1816, p. 82, pl. I, fig. 19-20.

1954. *Archaediscus moelleri* var. *gigas* RAUZER - CHERNOUSSOVA - GROZDILOVA & LEBEDEVA, p. 47-48, pl. V, fig. 7-8.

1968. *Archaediscus moelleri* var. *gigas* RAUZER - CHERNOUSSOVA, AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVIII, fig. 3-4.

Description

Test large for the genus, fusiform and involute except for the last volution. Globular initial chamber large, its diameter attains

about 0.064 mm. Deuteroloculus produces 4 to 4½ sigmoidally arranged whorls. Lumina much broader than high and increasing gradually in size with growth. Inner dark layer very thin. Outer hyaline layer thick.

Dimensions

Diameter of test: 0.37 to 0.50
Breadth of test: 0.25 to 0.30
Ratio of maximum breadth to diameter: 0.61 to 0.70

Remarks: except for the smaller size of our specimens, all other characters coincide with those described by RAUZER - CHERNOUSSOVA (1948).

Stratigraphic occurrence

Middle to upper Visean (Oka - Venev) of the USSR.
V3b of the central Alborz.

Archaediscus (Archaediscus) convexus GROZDILOVA & LEBEDEVA, 1953
pl. XXIII, fig. 7-9

1953. *Archaediscus convexus* GROZDILOVA & LEBEDEVA, p. 91, pl. II, fig. 11.

1954. *Archaediscus convexus* GROZDILOVA & LEBEDEVA - GROZDILOVA & LEBEDEVA, p. 48-49, pl. V, fig. 9-12.

1964. *Archaediscus convexus* var. *convexus* GROZDILOVA & LEBEDEVA - CONIL & LYS, p. 108-109, pl. XV, fig. 276-281.

1964. *Archaediscus convexus* GROZDILOVA & LEBEDEVA var. *declinata* CONIL & LYS, pl. XV, fig. 282-283.

1968. *Archaediscus convexus* GROZDILOVA & LEBEDEVA - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XVII, fig. 9.

Description

Test medium-sized for the genus, lenticular and involute. Periphery rounded. Diameter of initial chamber from 0.028 to 0.042 mm.

Second chamber produces 5 to 7 sigmoidally coiled volutions. Lumina much broader than high and increasing rapidly in size with growth. Inner dark layer well developed. Outer layer relatively thin.

Dimensions

Diameter of test: 0.32 to 0.38
Breadth of test: 0.21
Ratio of maximum breadth to diameter: 0.55 to 0.66

Stratigraphic occurrence

Middle Visean to Baschkirian of the USSR.
V2b to V3b of Belgium.
V2b of the central Alborz.

Archaediscus (Archaediscus) stilus GROZDILOVA & LEBEDEVA var. *piesis* CONIL & LYS, 1964
pl. XXVII, fig. 11-13

1964. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA var. *piesis* CONIL & LYS, p. 121-122, pl. XVIII, fig. 353-355.

Description

Test small for the genus, discoidal, involute with planoparallel sides and rounded periphery. Initial chamber spheric, its maximum diameter about 0.028 mm. Tubular second chamber produces 5 to 6 volutions. Enrollment of the early 3 to 4 whorls oscillating, the last 2 whorls coiled planispirally. Lumina hemispherical, increasing gradually and slowly in size with growth. Inner dark layer well developed. Outer hyaline layer relatively thin.

Dimensions

Diameter of test: 0.27 to 0.32
Breadth of test: 0.085 to 0.093
Ratio of maximum breadth to diameter: 0.26 to 0.30

Stratigraphic occurrence

V2b to V3b of Belgium.
V3c of the central Alborz.

Subgenus RUGOSOARCHAEDISCUS MIKLUKO - MAKLAY, 1957
Archaediscus (Rugoscarchaediscus) demaneti CONIL & LYS, 1964
pl. XXII, fig. 5-6, 8-10

1964. *Archaediscus demaneti* CONIL & LYS, p. 111, pl. XV, fig. 193-194.

Description

Test lenticular with broadly rounded periphery. Diameter of initial chamber from 0.025 to 0.042 mm. Deuteroloculus produces 5 to 6 volutions. Coiling oscillating in the major part of the test, tending to become planispiral in the last 2 whorls. Lumina crescent-shaped and increasing gradually in size with growth. Nodosities well developed. Inner dark layer relatively thick.

Dimensions

Diameter of test: 0.33 to 0.42
Breadth of test: 0.14 to 0.15
Ratio of maximum breadth to diameter: 0.33 to 0.43

Stratigraphic occurrence

V2b to V3b of Belgium.
V2b of the central Alborz.

Archaediscus (Rugosoarchaediscus) latispiralis GROZDILOVA & LEBEDEVA
pl. XXVII, fig. 1-6

1953. *Archaediscus latispiralis* GROZDILOVA & LEBEDEVA, p. 102 - 103, pl. III, fig. 17.

1962. *Neoarchaediscus latispiralis* (GROZDILOVA & LEBEDEVA) - BOGUSH & JUFEREV, p. 207, pl. IX0 fig. 16.

1964. *Archaediscus* aff. *latispiralis* GROZDILOVA & LEBEDEVA - CONIL & LYS, p. 122, pl. XVIII, fig. 360.

Description

Test large for the genus, discoidal to nearly lenticular. Periphery broadly rounded. Proloculus large with a diameter of about 0.042 mm. Deuteroloculus forming 5 to 6 volutions. Early 3 whorls closely coiled and increasing slowly in size, last 3 volutions increasing rapidly in breadth. Enrollment oscillating in the early stage, nearly planispiral in the last 2 whorls. Nodosities strongly developed in the early portion, producing here a star - like feature and disappearing in the last 3 whorls. Inner dark layer of wall well developed.

Dimensions

Diameter of test: 0.42 to 0.54
Breadth of test: 0.19 to 0.20
Ratio of maximum breadth to diameter: 0.35 to 0.46

Remarks: this species is characterized by its type of coiling, the presence of rugosities in the central portion and by enlarging of spire in the last 3 whorls. Our specimens are generally larger in size than holotype. It can be distiguished from *Archaediscus complanatus* by the presence of nodosities in the central portion, from *Neoarchaediscus carnosus* by having a well developed planispiral portion, thinner wall in the final whorls and spacious lumina in the early stage.

Stratigraphic occurrence

Baschkirian of the USSR.
V3b of Belgium.
V3b to V3c of the central Alborz.

Archaediscus (Rugosoarchaediscus) cornua CONIL & LYS, 1964
pl. XX, fig. 9-12, pl. XXVII, fig. 14

1964. *Archaediscus cornua* CONIL & LYS, p. 109-110, pl. XV, fig. 284-285.

1968. *Archaediscus cornua* CONIL & LYS - CONIL & LYS, pl. V, fig. 14.

Description

Test medium-sized for the genus, lenticular. Periphery rounded. Initial chamber spheric, its diameter 0.042 mm. Second chamber produces 6 to 7 volutions. Plane of coiling alternatively changes in position in every 2 whorls. Lumina crescent-shaped, increasing gradually in size. Rounded nodosities present at the base of the lumina. Inner layer well developed.

Dimensions

Diameter of test: 0.31 to 0.34
Breadth of test: 0.14 to 0.15
Ratio of maximum breadth to diameter: 0.41 to 0.47

Stratigraphic occurrence

V2b of Belgium.
V3 of Germany.
V2b to V3b of the central Alborz.

Archaediscus (Rugosoarchaediscus) tchalussensis
BOZORGNIA, nov. sp.
pl. XX, fig. 6-9

Derivatio nominis: Chalus, nearest town to the type locality.
Holotype: pl. XXV, fig. 6.
Locus typicus: Dozdehband section, N of Kandevan pass.
Stratum typicum: V2b.
Diagnosis: this species is characterized by its large size, thicker wall, well developed nodosities, oscillating type of coiling in the early portion and planispiral in the final whorls.

Description

Test large for the genus, lenticular, with convex sides and broadly rounded periphery. Initial chamber small with a diameter of about 0.022 mm. Second chamber produces 5 to 6 (7) volutions.

Enrollment in the early stage oscillating and planispiral in the final whorls. Lumina broader than high and increasing gradually in size with growth. Inner dark layer well developed. Outer hyaline layer thick. Nodosities present throughout the whorls.

Dimensions

Diameter of test: 0.33 to 0.42
Breadth of test: 0.15 to 0.22
Ratio of maximum breadth to diameter: 0.35 to 0.54

Remarks: this species resembles but differs from *Archaediscus (Archaediscus) pulvinus* by the presence of the well developed nodosities throughout the whorls. The strong similarities existing between these two forms suggest that *Archaediscus (Rugosoarchaediscus) tchalussensis* should have been derived from *Archaediscus (Archaediscus) pulvinus*.

Stratigraphic occurrence

V2b to V3a of the central Alborz.

Archaediscus (Rugosoarchaediscus) stellatus BOZORGNIA, nov. sp.
pl. XXVI, fig. 1-4

1954. *Archaediscus akchimensis* GROZDILOVA & LEBEDEVA, p. 53, pl. V, fig. 13 only.

1962. *Neoarchaediscus* akchimensis (GROZDILOVA & LEBEDEVA) - BOGUSH & JUFEREV, p. 208-209, pl. IX, fig. 18.

Derivatio nominis: stellatus, stellate
Holotype: pl. XXVI, fig. 1
Locus typicus: Chaboksar section, W of Ramsar.
Stratum typicum: V3b
Diagnosis: Archaediscus (Rogosoarchaediscus) stellatus is characterized by the sigmoidal type of enrollment, thickness of the outer layer of the wall and arrangement of the nodosities in the early stage of test.

Description

Test ovoid with strongly convex sides and rounded periphery. Initial chamber relatively small with a diameter of 0.035 mm. Tubular second chamber produces 4 to 5 (6) sigmoidally arranged volutions. Lumina small in the early stage of growth, increasing rapidly in size in the last 3 whorls. Inner dark layer of wall weakly developed. Outer hyaline layer thick. Nodosities present only in the early portion of test and here produce a star-like feature.

Dimensions

Diameter of test: 0.39 to 0.46
Breadth of test: 0.22 to 0.29
Ratio of maximum breadth to diameter: 0.54 to 0.63

Stratigraphic occurrence

Lower Baschkirian of the USSR.
V3a to V3b of the central Alborz.

Remarks: the holotype of *Archaediscus akchimensis* pl. VI, fig. 1 of GROZDILOVA & LEBEDEVA (1952) is synonym of *Archaediscus (Rugosoarchaediscus) karreriformis*. The paratype of A. *akchimensis* illustrated by pl. V, fig. 13 of GROZDILOVA & LEBEDEVA however is a new species different from *Archaediscus (Rugosoarchaediscus) karreriformis* = (A. akchimensis). It differs from *Archaediscus saleei* by having nodosities only in the central portion and from *Archaediscus selsus* in being much smaller in size.

Archaediscus (Rugosoarchaediscus) permodiscoides
REITLINGER, 1950
pl. XXVIII, fig. 1,2,4,5,7, 7-12

1950. *Archaediscus permodiscoides* REITLINGER, p. 85, pl. XVIII, fig. 5.

Description

Test large for the genus, oval in axial section with convex sides

and broadly rounded periphery. Diameter of initial chamber about 0.030 to 0.045 mm. Second chamber with 5 to 6 volutions. Enrollment oscillating throughout the test. Crescent-shaped lumina increasing gradually in size. Nodosities well developed. Inner dark layer weakly developed. Outer hyaline layer thick.

Dimensions

Diameter of test: 0.30 to 0.45
Breadth of test: 0.13 to 0.23
Ratio of maximum breadth to diameter: 0.41 to 0.51

Stratigraphic occurrence

Upper Namurian of the USSR.
V3b to V3c of the central Alborz.

Archaediscus (Rugosoarchaediscus) karreriformis
REITLINGER, 1950
pl. XXV, fig. 415

1950. *Archaediscus karreriformis* REITLINGER, p. 83, pl. XVIII, fig. 6-7.

1954. *Archaediscus akchimensis* GROZDILOVA & LEBEDEVA, pl. VI, fig. 1, non pl. V, fig. 13.

Description

Test large for the genus, lenticular, with narrowly rounded periphery and convex sides. Initial chamber spheric with a diameter of 0.028 to 0.32 mm. Tubular second chamber with 5 to 6 volutions. Enrollment oscillating throughout the test. Axis of coiling changes markedly in position from whorl to whorl. Lumina small in the early stage, increasing rapidly in size in the last 3 whorls. Nodosities well developed in the central portion of the test.

Dimensions

Diameter of test: 0.35 to 0.46

Breadth of test: 0.23 to 0.24
Ratio of maximum breadth to diameter: 0.52 to 0.66

Stratigraphic occurrence

Lower Baschkirian of the USSR.
V3b of the central Alborz.

Archaediscus (Rugosoarchaediscus) reditus CONIL & LYS, 1964
pl. XXVIII, fig. 3

1964. *Archaediscus krestovnikovi* RAUZER - CHERNOUSSOVA var. *redita* CONIL & LYS, p. 122, pl. XVIII, fig. 365-369.

1968. *Archaediscus reditus* CONIL & LYS - CONIL & LYS, pl. XI, fig. 155.

Description

Test large for the genus, lenticular, involute except for the last whorl, with convex sides and broadly rounded periphery. Initial chamber spherical with a diameter of 0.04 mm. Tubular second chamber forms 6 whorls. Enrollment in early stage oscillating, almost planispiral in the last 3 volutions. Lumina crescent-shaped, increasing slowly in size in the central portion and rapidly in the last 3 whorls. Inner dark layer thin. Outer hyaline layer thick. Nodosities well developed in early stage. Last 1½ to 2 whorls devoid of nodosities.

Dimensions

Diameter of test: 0.42 to 0.45
Breadth of test: 0.21 to 0.22 J
Ratio of maximum breadth to diameter: 0.47 to 0.48

Stratigraphic occurrence

V3a to V3b of Belgium.
V3a of the central Alborz.

Archaediscus (Rugosoarchaediscus) dissolutus
BOZORGNIA, nov. sp.
pl. XXVIII, fig. 5-6

Derivatio nominis: dissolutus, meaning loose, disconnected; applied because of the loosely coiled whorls.

Holotype: pl. XXIII, fig. 5.

Locus typicus: Chaboksar section, 16 km W of Ramsar.

Stratum typicum: V3b

Diagnosis: a species of *Archaediscus* characterized by its relatively thin wall, small nodosities, and loosely coiled whorls.

Description

Test discoidal, involute except for the last 2 volutions, with nearly parallel sides and broadly rounded periphery. Diameter of initial chamber 0.028 mm. Second chamber forms 5 to 5½ whorls. Enrollment in central portion oscillating, becoming almost planispiral in the last 2 whorls. Inner dark layer weakly developed. Outer hyaline layer comparatively thin. Nodosities small and disappearing in the last 1½ to 2 whorls.

Dimensions

Diameter of test: 0.32 to 0.37
Breadth of test: 0.12 to 0.13
Ratio of maximum breadth to diameter: 0.36 to 0.37

Remarks: this species differs from *Archaediscus latispiralis* by its smaller size, thinner wall and the less pronounced nodosities.

Stratigraphic occurrence

V3b of the central Alborz.

Archaediscus (Rugosoarchaediscus) conili BOZORGNIA, nov. sp.
pl. XXV, fig. 1-3

Derivatio nominis: this species is named for Mr. R. Conil, University of Louvain, to whom the writer is indebted for his generous help during this study.
Holotype: pl. XXV, fig. 2.
Locus typicus: Valiabad section, N of Kandevan pass.
Stratum typicum: V2b.
Diagnosis: this species is characterized by the sigmoidal type of coiling in the major part of the test. In the final stage, the deuteroloculus abandons the sigmoidal enrollment and shifts irregularly to one side. The outer hyaline layer is thick with strongly developed nodosities.

Description

Test medium-sized for the genus, lenticular and involute, except for the last volutions. Sides convex. Diameter of initial chamber 0.042 to 0.05 mm. Second chamber small in lumen, tightly coiled in early stage with 5 to 6 whorls. Coiling sigmoidal in major portion of test, but irregular with sharp shift to one side in last whorl. Inner, dark layer well developed. Outer hyaline layer thick. Strongly developed nodosities present throughout the whorls.

Dimensions

Diameter of test: 0.32 to 0.45
Breadth of test: 0.17 to 0.25
Ratio of maxumum breadth to diameter: 0.52 to 0.57

Remarks: the only species that can be compared with *Archaediscus (Rugosoarchaediscus) conili* is *Archaediscus karreriformis.* However the new species can easily be distinguished by the early sigmoidal, not oscillating, type of coiling from *Archaediscus karreriformis.*

Stratigraphic occurrence

V2b to V3b of the central Alborz.

Archaediscus (Rugosoarchaediscus) mutans CONIL & LYS, 1946
pl. XXVI, fig. 8-10

1964. *Archaediscus mutans* CONIL & LYS, p. 125, èl. XIX, fig. 371.

Description

Test medium-sized for the genus, lenticular and involute except for the last whorl. Initial chamber spheric with a diameter of 0.043 mm. Tubular second chamber forming 5 to 6 whorls. Plane of coiling of last 3 whorls nearly perpendicular to those of early portion. Lumen of deuteroloculus increasing gradually in size with growth. Wall relatively thin. Nodisities present only in the central portion of test.

Dimensions

Diameter of test: 0.32 to 0.37
Breadth of test: 0.12 to 0.17
Ratio of maximum breadth to diameter: 0.38 to 0.43

Stratigraphic occurrence

V3b of Belgium.
V3b of the central Alborz.

Archaediscus (Rugosoarchaediscus) tchaboksarensis BOZORGNIA, nov. sp.
pl. XXVII, fig. 7-10

Derivatio nominis: Chaboksar, nearest town to the type locality.
Holotype: pl. XXVII, fig. 7.

Locus typicus: Chaboksar section, 16 km W of Ramsar.

Stratum typicum: V3c

Diagnosis: this species is characterized by thick wall, strongly developed nodisities and planispiral enrollment in the major part of the test.

Description

Test lenticular, consisting of 6 whorls, involute except for the last 1 to 2 whorls. Initial chamber spheric with a diameter of 0.042 mm. Enrollment in the early stage oscillating, the last 3 whorls coiled planispirally. Lumina crescent-shaped, much broader than high and increasing gradually in size with growth. Nodosities strongly developed throughout the enrollment. Inner dark layer thin. Outer hyaline layer very thick.

Dimensions

Diameter of test: 0.32 to 0.42
Breadth of test: 0.11 to 0.14
Ratio of breadth to diameter: 0.28 to 0.38

Remarks: Archaediscus (Rugosoarchaediscus) tchaboksarensis is probably the ancestor of *Archaediscus (Asteroarchaediscus) postrugosus*. It differs from *Archaediscus (Asteroarchaediscus) postrugosus* by its less evolute enrollment and by less strongly developed nodisities.

Stratigraphic occurrence
V3b to V3c of the Central Alborz.

Subgenus NEOARCHAEDISCUS MIKLUKO-MAKLAY, 1955
Archaediscus (Neoarchaediscus) incertus GROZDILOVA & LEBEDEVA, 1955
pl. XXX, fig. 1-6

1954. *Archaediscus incertus* GROZDILOVA & LEBEDEVA, p. 60-61, pl. VII, fig. 14-15.

1964. *Neoarchaediscus incertus* (GROZDILOVA & LEBEDEVA) - CONIL & LYS, p. 130, pl. XX, fig. 389-391.

Description

Test small for the genus, discoidal, bilaterally compressed, with plano-parallel sides and rounded periphery. Involute in major part of test and evolute in last 2 whorls. Initial chamber with a diameter of 0.022 mm. Second chamber forming 5 to 6 volutions. Axis of coiling of inner whorls slightly changing in position. Last three whorls coiled planispirally. Lumina semi-circular and increasing gradually in size with growth. Wall thin. Inner dark layer poorly developed. Nodosities present throughout the enrollment.

Dimensions

Diameter of test: 0.22 to 0.27
Breadth of test: 0.052 to 0.082
Ratio of maximum breadth to diameter: 0.25 to 0.31

Stratigraphic occurrence

Upper Visean to Baschkirian of the USSR.
V3b to Namurian of Belgium.
V3c to lower Namurian of the central Alborz.

Archaediscus (Neoarchaediscus) exiguus BOZORGNIA, nov. sp.
pl. XXIV, fig. 17-21

Derivatio nominis: exiguus, small.

Holotype: pl. XXIV, fig. 21.

Locus typicus: Dozdehband section, N of Kandevan pass.

Stratum typicum: V3a.
Diagnosis: this species is characterized by its small size, well developed microgranular layer and oscillating type of enrollment.

Description

Test small for the genus, leticular with flattened sides and

narrowly rounded periphery. Initial chambers with a diameter of 0.028 to 0.042 mm. Deuteroloculus forming 5 to 6 whorls. Plane of coiling changes its position about 60° in every two volutions. Lumina crescent-shaped and increasing gradually in size with growth. Inner dark layer of wall well developed. Outer hyaline layer relatively thick. Nodosities present throughout the whorls.

Dimensions

Diameter of test: 0.21 to 0.22
Breadth of test: 0.071 to 0.085
Ratio of breadth to diameter: 0.3 to 0.4

Remarks: this species differs from all described species of *Neorchaediscus* by its small size, the type of enrollment and by its well developed inner microgranular layer.

Stratigraphic occurrence

V2o to V3c of the central Alborz.

Archaediscus (Neoarchaediscus) rostratus BOZORGNIA, nov. sp.
pl. XXIV, fig. 13-15

Derivatio nominis: rostratus; having a beak, refers to the general shape of the test.

Holotype: pl. XXIV, fig. 15.

Locus typicus: Dozdehband section, N of Kandevan pass.

Stratum typicum: V3a.

Diagnosis: this species is distinguished from all other neoarchaediscids by its small test, sigmoidal type of coiling and strongly developed nodosities. Further, the ratio of axial and equatorial diameter is relatively larger than that encountered in other neoarchaediscids.

Description

Test small for the genus, outline in axial view nearly sigmoidal, with flattened sides and narrowly rounded periphery. Initial chamber measures 0.035 to 0.042 mm. Second chamber with 4 to 5 whorls. Coiling sigmoidal. Lumina broader than high and increasing gradually in size with growth. Inner dark layer weakly developed, outer hyaline layer relatively thick. Nodsities well developed throughout the whorls.

Dimensions

Diameter of test: 0.23 to 0.25
Breadth of test: 0.11 to 0.12
Ratio of maximum breadth to diameter: 0.44 to 0.5

Remarks: the present species differs from *Archaediscus (Archaediscus) macer* by its sigmoidal type of coiling and strongly developed nodosities.

Stratigraphic occurrence

V3a to V3c of the central Alborz.

Archaediscus (Neoarchaediscus) planus BOZORGNIA, nov. sp.
pl. XXIV, fig. 6-12

Derivatio nominis: planus; flat.

Holotype: pl. XXIV, fig. 9.

Locus typicus: Dozdehband section, S of Chalus.

Stratum typicum: V3c.

Diagnosis: this species is characterized by its discoidal shape, and planispiral enrollment in the major part of the test.

Description

Test discoidal with 5 to 7 whorls, and involute except for the last volution. Periphery rounded. Sides flat and almost parallel to each other. Initial chamber usually small, from 0.021 to 0.035 mm. Lumen of second chamber minute in early stage, increasing progressively in size and becoming semi-circular in final whorls. Coiling in early portion of test oscillating, with small shifts in the position of the axis and becoming planispiral in last 3 whorls. Inner dark layer well developed, outer hyaline layer thick. Nodisities present throughout the whorls.

Dimensions

Diameter of test: 0.23 to 0.30
Breadth of test: 0.064 to 0.10
Ratio of maximum breadth to diameter: 0.22 to 0.26

Remarks: this species differs from *Archaediscus tchalussensis* by a smaller ratio of breadth to diameter and by a planispiral type of coiling in the major portion of the test. It differs from *Archaediscus (Neoarchaedscus) incertus*, which is probably evolved from this species, in being larger in size and possessing a well developed inner dark layer.

Stratigrapfic occurrence

V3b to V3c of the central Alborz.

Archaediscus (Neoarchaediscus) pirleti BOZORGNIA, nov. sp.
pl. XXIV, fig. 1-5

Derivatio nominis: this species has been named for Mr. H. Pirlet, University of Liege, Belgium.

Holotype: pl. XXIV, fig. 2.

Locus typicus: Dozdehband section, S of Chalus.

Stratum typicum: V3c.

Diagnosis: it is characterized by its narrow discoidal test as seen in axial view, oscillating enrollment and well developed nodosities.

Description

Test discoidal, with plano-parallel sides and rounded periphery. Enrollment involute. Initial chamber spheric with a diameter of 0.035 to 0.057 mm. Second chamber with 5 to 6 volutions, lumen tubular in inner whorls and semi-circular in outer ones. Size of lumins increasing gradually in inner 3 whorls but rapidly in last 2 to 3 whorls. Coiling oscillating throughout the test. Outer hyaline layer thin, and in lateral portion thickened by accumulation of succeeding whorls. Well developed nodisities present at base of lumina.

Dimensions

Diameter of test: 0.35 to 0.45
Breadth of test: 0.085 to 0.12
Ratio of maximum breadth of diameter: 0.26 to 0.32

Remarks: this species resembles *Archaediscus (Neoarchaediscus) planus*, nov. sp., but it differs from it by being larger in size, having a greater ratio of breadth to diameter and by an oscillating enrollment.

Stratigraphic occurrence

V3b to V3c of the central Alborz.

Archaediscus (Neoarchaediscus) gregorii var. *gregorii*
DAIN, 1953
pl. XXX, fig. 7-9

1953. *Archaediscus gregorii* var. *gregorii* DAIN, Trad. B.R.G.M., p. 108, pl. IV, fig. 12-13.

Description

Test small for the subgenus, discoidal, with plano-parallel sides and rounded periphery. Tubular second chamber forms 4 to 5 whorls. Axis of coiling of inner 2 whorls only slightly changing in position, last 2 to 3 whorls almost planispirally coiled. Initial portion involute, the final 3 whorls evolute. Due to strong development of a unique large nodosity deuterolocular lumen almost completely reduced into fissural space. Wall thick and virtually single-layered.

Dimensions

Diameter of test: 0.25 to 0.27
Breadth of test: 0.085 to 0.092
Ratio of maximum breadth to diameter: 0.33 to 0.35

Remarks: the present species is very similar to *Archaediscus (Asteroarchaediscus) rugosus* from which it differs by the following features: 1) small breadth, 2) planispiral enrollment of the final 3 whorls, 3) evolute type of coiling in the major portion of the test.

Stratigraphic occurrence

Upper Visean to Baschkirian of the USSR.
Uppermost Visean (V3c) - lower Namurian of the central Alborz.

Subgenus ASTEROARCHAEDISCUS MIKLUKO-MAKLAY, 1955
Archaediscus (Asteroarchaediscus) baschkiricus
KRESTOVNIKOV & THEODOROVICH, 1936
pl. XXX, fig. 17, 21-24

1936. *Archaediscus baschkiricus* KRESTOVNIKOV & THEODOROVICH p. 87, text-fig. 2-3.

1953. *Archaediscus baschkiricus* var. *baschkiricus* KRESTOVNIKOV & THEODOROVICH-GROZDILOVA, p. 100-101, pl. III, fig. 12.

1962. *Asteroarchaediscus baschkiricus* (KRESTOVNIKOVA & THEODOROVICH) - BOGUSH & JUFEREV, p. 204-205, pl. IX, fig. 12.

1968. *Asteroarchaediscus baschkiricus* (KRESTOVNIKOV & THEODOROVICH) - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XXIV, fig. 7.

Description

Test small for the subgenus consisting of 5 volutions, lenticular with broadly rounded periphery. Outline oval in axial section. Last 2 to 3 whorls evolute. Coiling oscillating throughout the test. Hyaline layer thick with distinct ondulations producing star-like feature in central portion of test. Lumina strongly reduced. Inner layer of the wall not clearly discernable.

Dimensions

Diameter of test: 0.17 to 0.2
Breadth of test: 0.11 to 0.15
Ratio of maximum breadth to diameter: 0.48 to 0.51

Stratigraphic occurrence

V3c (Mikhailov) to lower Moscovian of the USSR.
Uppermost Visean (V3c)-lower Namurian of the central Alborz.

Archaediscus (Asteroarchaediscus) rugosus RAUZER - CHERNOUSSOVA, 1948
pl. XXX, fig. 14-16, 18-20

1948. *Archaediscus rugosus* BAUZER-CHERNOUSSOVA, p. 11, pl. III, fig. 4-6.

1962. *Asteroarchaediscus rugosus* (BAUZER-CHERNOUSSOVA) - BOGUSH & JUFEREV, p. 205, pl. IX, fig. 13.

Description

Test small for the genus, nearly discoidal and involute except for last 2 whorls. Periphery broadly rounded. Lateral sides almost flat or slightly convex. Second chamber with 4 to 5 whorls, coiled with slight deviations from plane of symmetry of test. Chamber lumen small. Wall thick and virtually single-layered with well deve-

loped unique nodosity.

Dimensions

Diameter of test: 0.21 to 0.24
Breadth of test: 0.10 to 0.11
Ratio of maximum breadth to diameter: 0.42 to 0.48

Remarks: the present species differs from *Archaediscus baschkiricus* by its flatter from, and the absence of the star-like feature in the central portion.

Stratigraphic occurrence

Upper Visean to lower Namurian of the USSR.
Uppermost Visean (V3c)-lower Namurian of the central Alborz.

Archaediscus (Asteroarchaediscus) postrugosus
REITLINGER, 1949
pl. XXX, fig. 10-13, 19

1949. *Archaediscus postrugosus* REITLINGER, p. 162, pl. I, fig. 10 a, c.

1953. *Archaediscus postrugosus* REITLINGER-GROZDILOVA, Trad. B.R.G.M., p. 109-110, pl. IV, fig. 9-10.

1962. *Neoarchaediscus postrugosus* (REITLINGER) - BOGUSH & JUFEREV, p. 207-208, pl. IX, fig. 17.

1968. *Asteroarchaediscus postrugosus* (REITLINGER) - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XXIV, fig. 9.

Description

Test small for the subgenus, lenticular and involute, except for last 1½ to 2 whorls. Periphery narrowly rounded. Second chamber forms 5 to 6 (7) sigmoidally arranged whorls. Early stage tightly coiled, last 1½ to 2 whorls increasing rapidly in height. Lumina very small in central portion, becoming larger in last 2 whorls. Wall thick, virtually without inner layer with strongly developed nodisities.

Dimensions

Diameter of test: 0.28 to 0.31
Breadth of test: 0.10 to 0.11
Ratio of maximum breadth to diameter: 0.31 to 0.35

Remarks: this form differs from *Archaediscus rugosus* RAUZER-CHERNOUSSOVA by its comparatively large size, convexity of the lateral sides, and large lumen of the final whorl.

Stratigraphic occurrence

Upper Visean to Baschkirian of the USSR.
Lower Namurian of the central Alborz.

Family LASIODISCIDAE REITLINGER, 1956
Genus HOWCHINIA CUSHMAN, 1927
Howchinia gibba (MOELLER), 1879.
pl. XXIX, fig. 5, 7-8

1979. *Tetrataxis conica* EHRENBERG var. *gibba* MOELLER, p. 73, pl. VII, fig. 3

Description

Test trochoid, conical, and bilocular. Deuteroloculus coiled in 7 to 9 whorls around a large and deep umbilicus. Lumen of deuteroloculus increasing gradually in size. Umbilical cavity filled with microgranular calcite. Wall double-layered, inner layer dark and finely granular, outer layer light-colored and radiate.

Dimensions

Height of test: 0.21 to 0.26
Diameter of test: 0.26 to 0.36
Ratio of height to diameter: 0.66 to 0.81

Stratigraphic occurrence

Upper Visean (DI-D3) of England.

Upper Visean (Aleksin-Venev) of the USSR.
V3b of Belgium.
V3b of the central Alborz.

Family TEXTULARIIDAE EHRENBERG, 1838
Genus TEXTULARIA DEFRANCE, 1824
Textularia lipinae (CONIL & LYS), 1964.
pl. XXIX, fig. 4, 6

1964. *Paleotextularia? lipinae* CONIL & LYS, p. 83, pl. XI, fig. 208-209.

Description

Test conical, nearly triangular in axial section, consisting of proloculus and 4 to 5 pairs of chambers. Apical angle 35° to 45°. Chambers increasing gradually and uniformly in size with growth. Septa as thick as the wall, strongly curved toward the aperture and slightly thickened at the ends. Wall single-layered, relatively thick and agglutinated, composed of numerous large, angular and light-colored particles within the microgranular dark mass.

Dimensions

Height of test: 0.50 to 0.52
Breadth of test: 0.30 to 0.32

Stratigraphic occurrence

V2b to V3a of Belgium.
V2b to V3a of the central Alborz.

Family PALEOTEXTULARIIDAE GALLOWAY, 1933
Genus CLIMACAMMINA BRADY, 1873
Climacammina valvulinoides LANGE, 1925
pl. XXXIII, fig. 1

1925. *Climacammina valvulinoides* LANGE, p. 243, pl. II, fig. 43.

Description

Test very large for the genus. Biserial early portion cuneiform and laterally compressed, enlarging gradually from the initial end up to 4 to 5 pairs of chambers. Its length almost equal to 1/3 of total length of test. Following uniserial stage subconical. Distinct constriction at passage from biserail to later uniserial portion. Uniserial stage consisting of 6 to 7 low, broad and gradually increasing chambers. Sutures distinct. Septa convex. Wall calcareous, double-layered. Outer granular layer very thin in lateral walls, thicker along septa. Inner layer radiate and light-colored, in contrast to outer layer laterally very thick and thin or virtually absent along septa. Aperture cribrate with 7 openings in the apertural face of the last chamber.

Dimensions

Total length of test: 3 to 3.32
Maximum breadth of test: 1.3 to 1.6

Stratigraphic occurrence

Middle Permian of Sumatra.
Lower to middle Murghabian of the central Alborz.

Climacammina major MOROZOVA, 1949
pl. XXXIII, fig. 2, 3

1949. *Climacammina major* MOROZOVA, Trad. B.R.G.M., no. 783, p. 29, pl. IV, fig. 1-3

Description

Test smaller than that of *Climacammina valvulinoides*, elongate. Early stage short, slightly compressed laterally and consisting of 3 to 4 pairs of chambers. Uniserial stage almost subcylindrical, consisting of 6 to 7 low, broad and very slowly increasing chambers. Sutures slightly depressed. Septa convex. Wall calcareous, double-layered.

Outer microgranular layer thin and dark. Inner radiate layer thick. Aperture cribrate, number of openings increasing toward the end of test with 6 to 7 openings in apertural face of last chamber.

Dimensions

Total length of test: 2 to 2.4
Maximum breadth of test: 0.8 to 0.9

Remarks: this species differs from *Climacammina valvulinoides* by its smaller size and subcylindrical outline of the uniserial stage.

Stratigraphic occurrence

Middle Permian of the USSR.
Lower to middle Murghabian of Afghanistan.
Lower to middle Murghabian of the central Alborz.

Climacammina moelleri REITLINGER, 1950
pl. XXXIII, fig. 4

1950. *Climacammina moelleri* REITLINGER, Trad. B.R.G.M., no. 1456, p. 47, pl. XIII, fig. 2, 3.

1963. *Climacammina moelleri* REITLINGER - BOGUSH, p. 57, pl. I, fig. 12.

Description

Test large for the genus, elongate, conical in early biserial and nearly cylindrical in later uniserial stage with distinct constriction at passage from biserial to uniserial portion. Uniserial stage almost equal or slightly longer than biserial one. Five pairs of chambers in biserial stage, uniserial portion only 3 to 4 chambers. Septa convex. Wall double-layered, outer granular layer dark-colored, its maximum thickness along septa, inner hyaline layer well developed laterally but in septa not distinct. Four to 5 openings in apertural face of last chamber.

Description

Total length of test: 1.6 to 1.8
Maximum breadth of test: 1 to 1.1

Stratigraphic occurrence

Middle Carboniferous, Podal'sk and Myotchkovo, of the USSR.
Lower to middle Murghabian of the central Alborz.

Genus CRIBROGENERINA SCHUBERT, 1907
Cribrogenerina sumatrana (VOLZ), 1904
pl. XXXIII, fig. 6

1904. *Bigenerina sumatrana* VOLZ, p. 95, fig. 6.

1925. *Cribrogenerina obesa* LANGE, p. 248, pl. II, fig. 49.

1933. *Cribrogenerina sumatrana* (VOLZ) - GALLOWAY, p. 224, pl. XX fig. 8.

1950. *Cribrogenerina sumatrana* (VOLZ) - DOUGLAS, p. 43, pl. IV, fig. 9.

1964. *Cribrogenerina sumatrana* (VOLZ) - BOZORGNIA & BANAFTI, pl. XXXIX, fig. 4.

Description

Test large for the genus, cylindro-conical, consisting of 5 to 8 uniserially arranged, short, and broad chambers. Septa convex. Sutures distinct and slightly depressed. Wall double-layered, outer granular layer laterally thin, but very thick along septa. Aperture cribrate, number of openings in final chamber about 10 to 11.

Dimensions

Total length of test: 1.92 to 3
Maximum breadth of test: 1.4 to 2

Stratigraphic occurrence

Middle Permian of Sumatra.

Murghabian of the Alborz Mountains.

Family DAGMARITIDAE BOZORGNIA, nov. fam.

Definition

Test free, biserial. Wall double-layered, outer layer hyaline, thin, and radiate, inner layer dark, microgranular and thick. Inner granular layer extending over septum of preceding chamber. Aperture single, interiomarginal.

Type genus: ADGMARITA REITLINGER, 1965.

Remarks: the family *Dagmaritidae* differs from the family *Biseriamminidae* N. CHERNYSHEVA by the fact that the wall of the latter is single-layered. Further the tests of the *Biseriamminidae* are enrolled.

Genus DAGMARITA REITLINGER, 1965
Dagmarita chanakchiensis REITLINGER, 1965
pl. XXXIX, fig. 6-8

1965. *Dagmarita chanakchiensis* REITLINGER, p. 63, pl. I, fig. 10-12.

Description

Test small, compressed as *Textularia*, consisting of 6 to 8 pairs of biserially arranged chambers which increase rapidly in height, slowly in width and produce marginal thorn-like features. Septa convex, hook-shaped thickenning at their apertural ends. Wall calcareous, double-layered. Inner dark layer microgranular, outer hyaline layer radiate and thin. Septa appear to be 3 layered because microgrnular layer of succeding chamber extends over hyaline layer of preceding one.

Dimensions

Length of test: 0.4 to 0.6

Maximum breadth of test: 0.43

Stratigraphic occurrence

Upper Permian, Gnishik to Arax beds of the Transcaucasian territory.
Julfian, Nessen formation of the Central Alborz.

Family BISERIAMMINIDAE N. CHERNYSHEA, 1941
Genus PARAGLOBIVALVULINA REITLINGER, 1965
Paraglobivalvulina mira REITLINGER, 1965
pl. XXXIX, fig. 9-11, pl. XL, fig. 1-2

1965. *Paraglobivalvulina mira* REITLINGER, p. 64, pl. I, fig. 14.

Description

Test large, globular, completely involute, biserial, spirally coiled as in *Globivalvulina*. Additional interseptal stolos. Wall calcareous, single-layered, microgranular and thick.

Dimensions

Diameter of test: 1.7 to 2.8
Thickness of the wall: 0.068 to 0.18

Stratigraphic occurrence

Upper Permian, Chanakschinsk beds of Dzhulfa horizon of Transcaucasian territory.
Julfian, Nesson formation of the central Alborz.

Genus GLOBIVALVULINA SCHUBERT, 1921
Globivalvulina vonderschmitti REICHEL, 1945
pl. XLII, fig. 5

1945. *Globivalvulina vonderschmitti* REICHEL, p. 556, text-fig. 37a-e.

Description

Test large for the genus, subglobular biserial and enrolled. Chambers increasing very rapidly in size with growth showing internal folds. Wall calcareous, single-layered and microgranular.

Dimensions

Diameter of test: 0.75

Stratigraphic occurrence

Upper Permian of Greece.
Julfian, Nessen formation of the central Alborz.

Superfamily FUSULINACEA MOELLER, 1878
Family OZAWAINELLIDAE TOMPSON & FOSTER, 1937
Genus EOPARASTAFFELLA VDOVENKO, 1953
Eoparastaffella simplex VDOVENKO forma *typica*, 1954
pl. VIII, fig. 6-7, 13

1954. *Eoparastaffella simplex* VDOVENKO, Trad. B.R.G.M., no. 1618, p. 3, pl. I, fig. 2.

1964. *Eoparastaffella simplex* VDOVENKO forma *typica* - VDOVENKO, p. 26-27, pl. II, fig. 1-10.

1968. *Pseudoendothyra (Eoparastaffella) simplex* VDOVENKO forma *typica* - CONIL & LYS, pl. VIII, fig. 132-134.

Description

Test spirally coiled, small, lenticular and involute. Periphery rounded to subacute. Umbilical region flat or slightly depressed. Initial coils endothyroid, later ones planispiral, total number of whorls 3 to 3½. Wall single layered, calcareous, granular, with many light-colored calcite grains. Pseudochomata present.

Dimensions

Diameter of test: 0.41 to 0.61

Breadth of test: 0.22 to 0.31
Maximum thickness of the wall: 0.03

Stratigraphic occurrence

V1a to V2a of the USSR.
V1b of Belgium.
V1a to V1b of the central Alborz.

Eoparastaffella simplex VDOVENKO forma *ovalis*, 1954
pl. VIII, fig. 8-12

1954. *Eoparastaffella ovalis* VDOVENKO, Trad. B.R.G.M., no. 1618, p. 4, pl. I, fig. 3-4.

1964. *Eoparastaffella simplex* VDOVENKO forma *ovalis* - VDOVENKO, p. 27, pl. I, fig. 1-3, 7-9.

Remarks: this form differs from *Eoparastaffella simplex* forma *typica* by having a more rounded peripheral region and a deeper and larger umbilicus.

Stratigraphic occurrence

Lower Visean of the USSR.
V1a of the central Alborz.

Genus MEDIOCRIS ROZOVSKAYA, 1961
Mediocris breviscula (GANELINA), 1951
pl. XX, fig. 5, 7

1951. *Eostaffella mediocris* VISSARINOVA var. *breviscula* GANELINA, p. 197-198, pl. III, fig. 1-3.

1954. *Eostaffella breviscula* GANELINA - GROZDILOVA & LEBEDEVA, p. 121-122, pl. XIII, fig. 12-13.

1956. *Eostaffella breviscula* GANELINA - GANELINA, p. 108, pl. XI, fig. 6-7.

1964. *Mediocris breviscula* (GANELINA) - CONIL & LYS, p. 238, pl. XI, fig. 840-841.

Description

Test small, planispirally coiled with 3 whorls, lenticular, compressed laterally with flat or very slightly convex umbilical areas. Periphery rounded. Wall single-layered calcareous, microgranular and dark. Lateral regions of test filled with massive supplementary deposits.

Dimensions

Diameter of test: 0.38 to 0.43
Breadth of test: 0.15 to 0.17
Ratio of maximum breadth to diameter: 0.4

Stratigraphic occurrence

Upper Visean, Aleksin, Mikhailov, Venev, Tarussa, of the USSR.
V2a to V2b of Belgium.
V2a to V2b of the central Alborz.

Genus EOSTAFFELLA RAUZER - CHERNOUSSOVA, 1948
Eostaffellla parastruwei RAUZER - CHERNOUSSOVA, 1948
pl. XX, fig. 6

1948. *Staffella (Eostaffella) parastruwei* RAUZER - CHERNOUSSOVA, p. 15, pl. III, fig. 16-18.

1964. *Eostaffella parastruwei* var. *parastruwei* RAUZER - CHERNOUSSOVA - CONIL & LYS, p. 236-237, pl. XI, fig. 827-836.

1968. *Eostaffella parastruwei* RAUZER - CHERNOUSSOVA - AIZENVERG, BRADZHNIKOVA & POTIEVSKAIA, pl. XIX, fig. 5.

Description

Test relatively large for the genus, biumbilicate, planispiral, consisting of 4 whorls, very slight deviation of axis of coiling in first volutions. Periphery narrowly rounded. umbilical depressions broad and deep. Height of volutions slowly and regularly increasing in early, but rather rapidly in final stage of enrollment. Wall calcareous, single-layered. Pseudochomata present.

Dimensions

Diameter of test: 0.6 to 0.76
Breadth of test: 0.36 to 0.4
Ratio of maximum breadth to diameter: 0.54 to 0.6

Stratigraphic occurrence

Upper Visean to Namurian of the USSR.
V1b to V3a of Belgium.
V2b to V3a of the central Alborz.

Family GEINITZINIDAE BOZORGNIA, nov. fam.

Definition

Test uniserial, wall double-layered with thin, inner, dark microgranular and thicker outer, hyaline layers.
Type genus: GEINITZINA SPANDEL, 1901.

Remarks: the new family GEINITZINIDAE differs from the NODOSINELLIDAE RHUMBLER, 1895, by a double-layered wall where the inner, not the outer layer as in the NODOSINELLIDAE, is of dark microgranular texture. From the NODOSARIIDAE EHRENBERG, 1838 the new family differs by a double-layered wall.

Genus LANGELLA DE CIVRIEUX & DESSAUVAGIE, 1965
Langella perforata (LANGE), 1925
pl. XXXIV, fig. 2, 5-6

1925. *Padangia perforata* LANGE, p. 228-229, pl. I, fig. 21a-b.

1964. *Padangia* sp. 1- BOZORGNIA & BANAFTI, pl. XL, fig. 6.

1965. *Langella perforata* subsp. - *langei* - DE CIVRIEUX & DESSAUVAGIE, p. 46, pl. X, fig. 3,5, pl. XIV, fig. 10, pl. XV, fig. 4.

Description

Test large for the genus, ovoid or subcylindrical in axial view,

consisting of 4 to 5 uniserially arranged chambers. Initial chamber spheric with a diameter of 0.14 to 0.15 mm. Subsequent chambers low, broad, partially embracing and gradually increasing in breadth to the penultimate chamber. Final chamber usually smaller than penultimate one. Septa convex and usually thinner than outer wall. Wall calcareous double - layered, inner layer thin, dark and finely granular, outer layer, thick and hyaline.

Dimensions

Length of test: 0.60 to 1.25
Breadth of test: 0.40 to 0.60
Maximum thickness of the wall. 0.11

Stratigraphic occurrence

This species was originally described from Middle Permian of Sumatra. It has been also found in the Upper Permian (Bellerophon Limestone) of Turkey and Middle Permian of Iranian Beluchestan. It is also reported from lower to middle Murghabian of the central Afghanistan. In the central Alborz it is restricted to the lower part of the Ruteh formation, lower to middle Murghabian .

Langella ocarina var. «*géante*» DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXIV, fig. 4

1965. *Langella ocarina* var. «*géante*» DE CIVRIEUX & DESSAUVAGIE, p. 48-49, pl. X, fig. 1, pl. XII, fig. 1.

Description

Test medium-sized for the genus, elongate, consisting of 8 to 9 uniserially arranged chambers. Initial chamber small, subsequent chambers much higher than broad, increasing gradually in breadth and rapidly in height. Septa strongly convex, much thinner than the wall in the early stage, and progressively thickening toward the end chamber. Wall calcareous, and double-layered. Inner dark layer very thin. Outer hyaline layer thick.

Dimensions

Length of test: 1 to 1.2
Breadth of test: 0.25 to 0.27
Maximum thickness of the wall: 0.055

Stratigraphic occurrence

Upper Permian (Bellerophon Limestone) of Turkey.
Murghabian, Ruteh formation of the central Alborz.

Langella acantha (LANGE), 1925
pl. XXXXVI, fig. 3

1925. *Nodosaria acantha* LANGE, p. 221-222, pl. I, fig. 10.

Description

Test large for the genus, elongate, rounded in tranverse section, consisting of 8 uniserially arranged chambers. Initial chamber small, subsequent chambers low, broad and gradually increasing to the fifth chamber, last 3 chambers almost of the same size as the fifth or even slightly smaller than previous chambers. Septa convex. Wall calcareous, and double-layered, relatively thick in early stage of growth, much thinner in last 3 chambers.

Dimensions

Length of test: 1.03
Breadth of test: 0.25

Stratigraphic occurrence

Middle Permian of Sumatra.
Murghabian, Ruteh formation of the central Alborz.

Langella venosa (LANGE), 1925
pl. XXXVI, fig. 5

1925. *Padangia venosa* LANGE, p. 230, pl. I, fig. 23.

Description

Test large for the genus, cylinro-conical in axial view, consisting of 7 to 9 uniserially arranged chambers. Initial chamber with a diameter of about 0.44 mm. Subsequent chambers broader than high and gradually enlarging to the fifth or seventh chamber, last 2 chambers almost as high as broad. Septa convex and usually thinner than test wall. Wall calcareous, double-layered, outer layer thick in the middle part of the test, becoming thinner toward the final chamber. Inner dark layer very thin throughout the test. Aperture rounded terminal and crater-shaped.

Dimensions

Length of test: 0.7 to 1
Breadth of test: 0.4
Maximum thickness of the wall: 0.08

Remarks: except for the smaller size, Iranian specimens agree with the form described and figured by LANGE from the Middle Permian of Sumatra.

Stratigraphic occurrence

Middle Permian of Sumatra.
Murghabian, Ruteh formation of the central Alborz.

Langella çukurköyi DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXV, fig. 3, 9

1965. *Langella çukurköyi* DE CIVRIEUX & DESSAUVAGIE, p. 47, pl. XI, fig. 5, pl. XIII, fig. 2, pl. pl. XV, fig. 5.

Description

Test small for the genus, conical, triangular in axial section, consisting of 5 to 6 low, broad, uniserially arranged chambers. Initial chamber with a diameter of about 0.063 mm. Subsequent chambers slightly embracing, increasing rapidly in breadth, and less so in

height. Septa convex, very thin in early stage, becoming nearly as thick as the outer wall in last 2 chambers. Wall calcareous, double-layered, inner dark layer very thin. Outer hyaline layer thick.

Dimensions

Length of test: 0.45 to 0.52
Breadth of test: 0.35 to 0.38
Maximum thickness of the wall: 0.033

Stratigraphic occurrence

Upper Permian (Bellerophon Limestone) of Turkey.
Julfian, Nessen formation of the central Alborz.

Langella conica DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXIV, fig. 1, pl. XXXV, fig. 1, pl. XXXVI, fig. 6

1965. *Langella conica* DE CIVRIEUX & DESSAUVAGIE, p. 49, pl. XII, fig. 3.

Description

Test medium-sized for the genus, conical, slightly compressed laterally, consisting of 5 to 6 uniserially arranged chambers. Initial chamber measures from 0.044 to 0.064 mm. Subsequent chambers low, broad, slightly overlapping and increasing rapidly in breadth. Septa thin in the early stage of ontogeny, thicker toward the final chamber. Wall calcareous, double-layered. Inner dark layer thin. Outer hyaline layer thick.

Dimensions

Length of test: 0.72 to 0.87
Breadth of test: 0.38 to 0.50

Stratigraphic occurrence

Upper Permian (Bellerophon Limestone) of Turkey.

Murghabian, Rueth formation to Julfian, Nessen formation of the central Alborz.

Genus PSEUDOLANGELLA DE CIVRIEUX & DESSAUVAGIE, 1965

Pseudolangella fragilis DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXV, fig. 2

1965. *Pseudolangella fragilis* DE CIVRIEUX & DESSAUVAGIE, p. 56, pl. X, fig. 2, pl. XII, fig. 2, pl. XV, fig. 6, pl. XVI, fig. 6, 9-11.

Description

Test small for the genus, elongate, consisting of 5 to 6 uniserially arranged chambers which increase gradually in size as added. Initial chamber spheric with a diameter of 0.15 mm in megalospheric and 0.06 mm in microspheric generations. Subsquent chambers curved, low, broad and slightly embracing. Septa convex, very thin in initial part, thicker toward apertural end and in last 2 chambers as thick as test-wall. Wall calcareous, double-layered, inner dark layer thin, outer hyaline layer thick. Thickness of wall varies between 0.30 and 0.04 mm.

Dimensions

Length of test: 0.6 to 0.8
Breadth of test: 0.4 to 0.5

Stratigraphic occurence

Upper Permian (Bellerophon Limestone) of Turkey.
Julfian, Nessen formation of the central Alborz.

Genus PACHYPHLOIA LANGE, 1925

Pachyphloia pedicula LANGE, 1925
pl. XXXVI, fig. 1, 2, 4.

1925. *Pachyphloia pediculus* LANGE, p. 232, pl. I, fig. 25.

Description

Test very large for the genus, wedge-shaped, with convex sides, consisting of 8 to 10 uniserially arranged chambers. Iinitial chamber with a diameter of 0.2 mm. Subsequent chambers very broad, low, slightly embracing and increasing rapidly in breadth to the sixth or seventh chamber. Last 2 chambers equal or even slightly smaller than the preceding ones. Septa convex, they thicken and curve downward around terminal aperture. Wall calcareous double-layered, inner dark layer very thin, outer hyaline layer thick.

Dimensions

Length of test: 0.84 to 1.14
Breadth of test: 0.55 to 0.61
Maximum thickness of the wall: 0.13

Remarks: LANGE based the description of this species on the study of an oblique section of a single specimen. In our material many sections in different directions have been encountered and one of our oblique section is identical with that illustrated by LANGE's pl. I, fig. 25. This species resembles *Pachyphloia schwageri*, but differs by being larger and having thicker wall in the plane of compression.

Stratigraphic occurrence

Middle Permian of Sumatra.
Uppermost Murghabian, upper part of the Ruteh formation to Julfian, Nessen formation of the central Alborz.

Pachyphloia iranica BOZORGNIA, nov. sp.
pl. XXXVII, fig. 1-6

Derivatio nominis: this species has been named after Iran.

Holotype: pl. XXXVII, fig 1.

Locus typicus: Amol section, 24 km S of Amol.

Stratum typicum: Julfian, Nessen formation.

Diagnosis: characterized by its large size, wedge-shaped test and numerous chambers.

Description

Test very large for the genus, wedge-shaped, strongly compressed laterally, consisting of 17 to 22 chambers. Iinitial chamber spheric with a diameter of about 0.055 to 0.66 mm. Subsequent chambers low, broad, increasing very rapidly in breadth and very slowly in height. Septa thin and thicken markedly around the aperture. Apertural face slightly convex. Aperture terminal, narrov and slit-like. Wall calcareous double-layered, inner dark layer very thin, outer hyaline layer thick.

Dimensions

Length of test: 0.83 to 0.92
Breadth of test: 0.60 to 0.62
Maximum thickness of wall: 0.077 to 0.11
Height of the last chambers: 0.044

Remarks: the only species resembling this species is *Pachyphloia multiseptata,* but LANGE's description does not contain all the criteria of this species. LANGE (1925, p. 176) stated "Bei manchen Axialschnitten sind die kammern breiter als hoch bei anderen hoeher als breit". Furthermore, LANGE's figures are all from oblique sections. The present species differs from *Pachyphloia multiseptata* by its larger szie, numerous and much broader than high chambers.

Stratigraphic occurrence

Upper Murghabian, upper part of the Ruteh formation to Julfian, Nessen formation.

Pachyphloia çukurköyi DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXV, fig. 7, 12, pl. XXXVII, fig. 7-8

1965. *Pachyphloia çukurköyi* DE CIVRIEUX & DESSAUVAGIE, p. 37-38, pl. IV, fig. 3, pl. V. fig. 2, 8, 9, pl. VI, fig. 3, 4, 6-8, pl. VII, fig. 1, 4, pl. IX, fig. 4, pl. XIII, fig. 4.

Description

Test small for the genus, subtriangular in axial section and oval in transverse section, consisting of 7 to 10 unserial chambers. Iintial chamber small with a diameter of about 0.033 mm. Subsequent chambers low, broad, slightly embracing and rapidly broadening. Septa thinner than wall and convex. Wall calcareous double-layered, inner dark layer very thin, outer hyaline layer thick along lateral faces.

Dimensions

Length of test: 0.3 to 0.42
Breadth of test: 0.17
Maximum thickness of wall: 0.061 to 0.064

Stratigraphic occurrence

Upper Permian, Bellerophon Limestone of Turkey.
Upper Murghabian, upper part of the Ruteh formation to Julfian, Nessen formation.

Genus GEINITZINA SPANDEL, 1901
Geinitzina primitiva POTIEVSKAIA, 1962
pl. XXXIV, fig. 7

1962. *Geinitzina primitiva* POTIEVSKAIA, p. 75, pl. VII, fig. 1-8.

Description

Test small for the genus, wedge-shaped, subtriangular in axial section, consisting of 3 to 4 uniserial chambers. Initial chamber very large with a diameter of 0.092 to 0.1 mm. Subsequent chambers low,

broad, slightly embracing and increasing rapidly in breadth toward apertural end. Sutures distinct and slightly depressed. Septa convex upwards, nearly as thick as test wall. Wall calcareous double-layered, inner dark layer thin, outer hyaline layer slightly thicker.

Dimensions

Length of test: 0.22 to 0.24
Breadth of test: 0.23 to 0.25
Height of the last chamber: 0.055

Stratigraphic occurrence

Lower Permian, Solenos of the USSR.
Murghabian, Ruteh formation to Julfian, Nessen formation of the central Alborz.

Geinitzina postcarbonica SPANDEL, 1901
pl. XXXIV, fig. 9

1901. *Geinitzina postcarbonica* SPANDEL, p. 198, text-fig. 8a-d.

1948. *Geinitzina postcarbonica* SPANDEL - LIPINA, Trad. B.R. G.M., no. 791, p. 26, pl. VII, fig. 8-9.

1962. *Geinitzina postcarbonica* SPANDEL - POTIESKAIA, p. 76, pl. VI, fig. 9-14.

1965. *Geinitzina postcarbonica* SPANDEL - DE CIVRIEUX & DESSAUVAGIE, p. 34, pl. I, fig. 1-13, 16-17, 20-25, pl. II, fig. 1-4, 7-10, pl. III, fig. 1-4, pl. VIII, fig. 2.

Description

Test small for the genus, wedge-shaped, consisting of 7 to 9 uniserial chambers. Initial chambers relatively large. Subsequent chambers low, broadly subquadratic in axial section and not embracing, increasing gradually in breadth to fifth chamber. Last 2 to 3 chambers as broad as high. Wall calcareous double-layered and thin.

Dimensions

Length of test: 0.27 to 0.30

Breadth of test: 0.11 to 0.16
Diameter of initial chamber: 0.03 to 0.035

Stratigraphic occurrence

This species has been found sporadically in the Murghabian to Julfian of the central Alborz.

Geinitzina taurica DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XXXIV, fig. 8

1965. *Geinitzina taurica* DE CIVRIEUX & DESSAUVAGIE, p. 35, pl. I, fig. 14, 15, 18, 19, 26, pl. II, fig. 11, 12.

Description

Test small for the genus, elongate, consisting of 7 to 8 chambers. Iinitial chamber small, spheric, with a diameter of about 0.028 mm. Subsequent chambers low, broad and increasing gradually in breadth up to about 4 times their height. Wall calcareous double-layered and thin.

Dimensions

Length of test: 0.2 to 0.21
Maximum breadth of test: 0.12

Remarks: a few specimens which resemble the present species were found in the Ruteh formation. These forms are very similar to *Geinitzina postcarbonica*. The differences between *Geinitbina taurica* and *Geinitzina postcarbonica* are the form of the chambers, which in *Geinitzina taurica* are much broader than high. Then the occurrence of high terminal chambers in *Geinitzina poscarbonica*. Possibly *Geinitzina taurica* is a junior synonym of *Geinitzina postcarbonica*.

Stratigraphic occurrence

Upper Permian, upper Bellerophon Limestone of Turkey.
Murghabian, Ruteh formation of the central Alborz.

Geinitzina chapmani SCHUBERT var. *longa* SULEIMANOV, 1948
pl. XXXV, fig. 11

1948. *Geinitzina longa* SULEIMANOV, p. 240-241, pl. I, fig. 8.

1949. *Geinitzina chapmani* SCHUBERT var. *longa* SULEIMANOV - LIPINA Trad. B.R.G.M., no. 791, p. 28, pl. VII, fig. 6.

1962. *Geinitzina chapmani* SCHUBERT var. *longa* SULEIMANOV - POTIEVSKAIA, p. 77, pl. VIII, fig. 1-5.

Description

Test large for the genus, wedge-shaped, consisting of 10 to 12 chambers. Initial chamber small with a diameter of 0.03 to 0.04 mm. Subsequent chambers low, slightly embracing and increasing gradually in breadth up to the seventh or eight chamber. Last 3 to 4 chambers nearly subquadratic. Septa curved and as thick as test wall. Wall calcareous, double-layered, inner microgranular layer thin, outer hyaline layer thick.

Dimensions

Length of test: 0.52 to 0.71
Breadth of test: 0.22 to 0.27

Stratigraphic occurrence

Lower Permian of the USSR.
Murghabian, Ruteh formation of the central Alborz.

Geinitzina uralica SULEIMANOV, 1949
pl. XXXV, fig. 4, 8

1949. *Geinitzina uralica* SULEIMANOV, Trad. B.R.G.M., pl. I, fig. 7.

Description

Test medium in size for the genus, subtriangular in axial section, markedly expanding in width with growth and consisting of

5 to 6 uniserial chambers. Initial chamber large and spheric. Subsequent chambers low and broad, increasing gradually in height and rapidly in breadth. Septa of first 2 to 3 chambers thin and nearly straight in axial line, while as thick as wall and slightly depressed in last chambers. Wall calcareous, double-layered, inner microgranular layer well developed, outer hyaline layer thick.

Dimensions

Length of test: 0.28 to 0.3
Breadth of test: 0.24 to 0.27
Diameter of the initial chamber: 0.055 to 0.1

Stratigraphic occurrence

Middle Permian of the USSR.
Murghabian of the central Alborz.

Geinitzina reperta E. BYKOVA, 1952
pl. XXXV, fig. 5-6

1952. *Geinitzina reperta* E. BYKOVA, p. 24, pl. V, fig. 3a-b, pl. VI, fig. 3a-c.

Description

Test relatively large for the genus, subtriagular in axial section, consisting of 8 to 10 chambers. Initial chamber spheric with a diameter of 0.1 to 0.12 mm and separated from following chamber by a distinct constriction. Subsequent chambers much broader than high and increasing gradually in size. Ultimate chamber sometimes smaller than penultimate. Septa thinner than wall and curved upward. Wall calcareous, double-layered, inner dark layer well developed and relatively thick, outer hyaline layer thick.

Dimensions

Length of test: 0.51 to 0.60
Breadth of test: 0.24 to 0.26
Thickness of the wall: 0.018 to 0.020

Stratigraphic occurrence

This species was first described by E. BYKOVA from Upper Devonian, Frasnian, Linvy beds of Voronezh area. It also occurs sporadically in the Murghabian of the central Alborz.

Suborder ROTALINA DELAGE & HEROUARD, 1896
Superfamily NODOSARIACEA EHRENBERG, 1838
Family NODOSARIIDAE EHRENBERG, 1838
Genus PROTONODOSARIA GERKE, 1963
Protonodosaria praecursor (RAUZER-CHERNOUSSOVA), 1949
pl. XLI, fig. 6

1949. *Nodosaria praecursor* - RAUZER - CHERNOUSSOVA, p. 349, pl. I, fig. 2-3.

1963. *Protonodosaria praecursor* (RAUZER-CHERNOUSSOVA) - GERKE, Trad. Inst. Fran. du Petrol, no. 10177, p. 18-20, pl. I, fig. 8, 9.

Description

Test small for the genus, elongate, subcylindrical, consisting of 5 to 6 uniserial nonembracing chambers. Iinital chamber subglobular and large. Subsequent chambers higher than broad in early stage, becoming broader than high in final stage of ontogeny. Septa are slightly curved upward and as thick as wall. Wall calcareous, and apparently hyaline-fibrous.

Dimensions

Length of test: 0.44 to 0.46
Breadth of test: 0.15

Stratigraphic occurrence

Artinskian to Upper Permian of the USSR.
Julfian, Nessen formation of the central Alborz.

Family indet.
Genus "ICHTYOLARIA" WEDEKIND, 1935
"Ichtyolaria" latilimbata DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XL, fig. 3-4, 8-9

1965. *Ichtyolaria latilimbata* DE CIVRIEUX & DESSAUVAGIE, p. 75, pl. V, fig. 41, pl. XIV, fig. 11.

Description

Test medium-sized for the genus, laterally compressed, rhomboidal to elliptical in axial and ovoid in transverse section, with rounded periphery. Initial chamber large and spheric. Subsequent chambers chevron-shaped. Chambers much broader than high, partially to completely embracing, increasing gradually in size. Septa as thick as wall. Wall calcareous, single-layered, not homogenous, consisting of darker microgranular portions and lighter almost hyaline radiate structured patches which are best developed toward the outer part of the wall.

Dimensions

Length of test: 0.37 to 0.60
Breadth of test: 0.25 to 0.40

Stratigraphic occurrence

Upper Permian, Bellerophon Limestone of Turkey.
Julfian, Nessen formation of the central Alborz.

Remarks: in order to determine the wall structure of ICHTYOLARIA WEDEKIND, the type of the genus *Frondicularia bicostata* D'ORBIGNY should be cut and the wall examined, at the present this is not feasible, hence we assigne with reservation only the present species from Julfian limestone to the genus ICHTYOLARIA. The texture of the single-layered wall of the Julfian forms is not homogenous. It shows patches of darker microgranular and light, radiate structured texture. The latter occur preferentially toward the outside of the test wall. We consider this wall as a transition between

a microgranular and a hyaline radiate textured wall.

Ichtyolaria nessenensis BOZORGNIA, nov. sp.
pl. XL, fig. 7

Derivatio nominis: Nessen, nearest village to the type locality.

Holotype: pl. XL, fig. 7.

Locus typicus: Nessen section, N of Kandevan pass.

Stratum typicum: Julfian, Nessen formation.

Diagnosis: test elongate; chambers chevron-shaped; enlargment of chambers not uniform, smaller and larger chambers alternatively formed.

Description

Test medium-sized for the genus, elongate, slightly compressed, consisting of 6 to 7 chambers which increase unevenly in size, smaller and larger chambers alternating toward apertural end. Septa strongly curved upwards and as thick as wall .Wall calcareous, finely granular and with fibrous appearance in adult stage.

Dimensions

Length of test 0.55 mm.
Breadth of test 0.275 mm.
Thickness of the wall: 0.005 mm.

Stratigraphic occurrence

Upper part of the Nessen formation, Julfian.

Ichtyolaria primitiva DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XL, fig. 5-6

1965. *Ichtyolaria primitiva* DE CIVRIEUX & DESSAUVAGIE, p. 74, pl. V, fig. 30, 31.

Description

Test medium-sized for the genus, elongate, slightly compressed laterally, consisting of 5 to 6 uniserial and partially embracing chambers with slightly lobulate periphery. Initial chamber rounded. Subsequent chambers as high as broad. Sutures depressed. Aperture large. Wall calcareous, single-layered, apparently microgranular.

Dimensions

Length of test: 0.51 to 0.60
Breadth of test: 0.23 to 0.24

Stratigraphic occurrence

Upper Permian, Bellerophon Limestone of Turkey.
Julfian, Nessen formation of the central Alborz.

Genus FRONDINA DE CIVRIEUX & DESSAUVAGIE, 1965

Frondina permica DE CIVRIEUX & DESSAUVAGIE, 1965
pl. XL, fig. 2, 4

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Description

Test small for the genus, elongate, elliptical in axial section, consisting of 4 to 5 uniserial chambers. Initial chamber large and spheric. Subsequent chambers broader than high or as high as broad and slightly to strongly overlapping. Septa strongly curved toward the initial chamber, and sometimes chevron-shaped. Wall calcareous and finely granular.

Dimensions

Length of test: 0.33 to 0.43
Breadth of test: 0.16 to 0.18
Diameter of the initial chamber: 0.04 to 0.06

Stratigraphic occurrence

Upper Permian, Bellerophon Limestone of Turkey.
Julfian, Nessen formation of the central Alborz.

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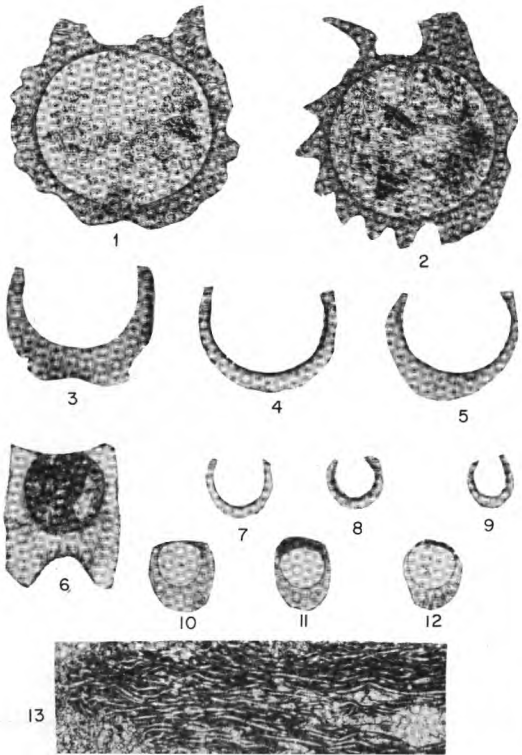
FOSSIL INDEX

PLATE I(1)



EXPLANATION OF PLATE I

"All figured specimens are from the type section of the Khoshyeilagh formation, NE of Shahrud"

Trochiliscus sp.
Fig. 1-2 *Upper Couvinian*, sample no. Me. 261 X70

Umbella baschkirica E. BYKOVA
Fig. 3 *Upper Frasnian*, sample no. Me. 1516 X70

Umbella hemisphaerica POJARKOV
Fig. 4 *Upper Frasnian*, sample no. Me. 1515 X70
Fig. 5 *Upper Frasnian*, sample no. Me. 1508 X70

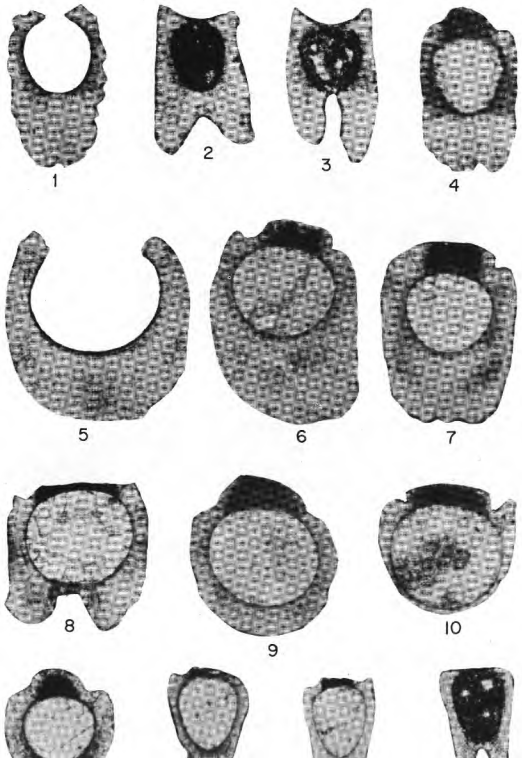
Umbella bella MASLOV
Fig. 6 *Upper Frasnian*, sample no. Me. 1515 X70

Umbella nana REITLINGER
Fig. 7-9 *Upper Frasnian*, sample no. Me. 1515 X70

Umbella ovata BOZORGNIA, nov. sp.
Fig. 10 *Upper Frasnian*, sample no. Me. 1515 X70 (*HOLOTYPE*)
Fig. 11 *Upper Frasnian*, sample no. Me. 1518 X70
Fig. 12 *Upper Frasnian*, sample no. Me. 1515 X70

Girvanella ducii WETHERED
Fig. 13 *Upper Famennian*, sample no. Bz. 2486 X110

PLATE II (Y)



EXPLANATION OF PLATE II

"All figured specimens are from the type section of the Khoshyeilagh formation, NE of Shahrud"

Umbella bella MASLOV

Fig. 1 *Upper Frasnian*, sample no. Me. 1516 X70
Fig. 2,4 *Upper Frasnian*, sample no. Me. 1518 X70
Fig. 3 *Upper Frasnian*, sample no. Me. 1517 X70

Umbella baschkirica E. BYKOVA

Fig. 5 *Upper Frasnian*, sample no. Me. 1519 X70

Umbella shahrudensis BOZORGNIA, nov. sp.

Fig. 6 *Upper Frasnian*, sample no. Me. 1518 X70
Fig. 7 *Upper Frasnian*, sample no. Me. 1516 X70 (*HOLOTYPE*)

Umbella sumsariensis POJARKOV

Fig. 8 *Upper Frasnian*, sample no. Me. 1515 X70

Umbella rotunda E. BYKOVA

Fig. 9 *Upper Frasnian*, sample no. Me. 1516 X70
Fig. 11 *Upper Frasnian*, sample no. Me. 1515 X70

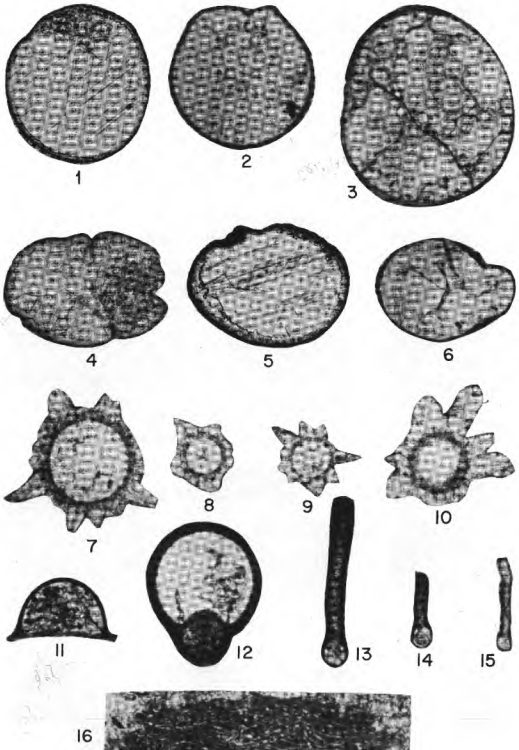
Umbella cutis CONIL & LYS

Fig. 10 *Upper Frasnian*, sample no. Me. 1516 X70

Umbella reitlingerae BOZORGNIA, nov. sp.

Fig. 12,14 *Upper Frasnian*, sample no. Me. 1538 X70
Fig. 13 *Upper Frasnian*, sample no. Me. 1537 X70 (*HOLOTYPE*)

PLATE III (۳)



EXPLANATION OF PLATE III

Bischaera irregularis BIRINA

Fig. 1-2 *V1a*, Mobarak formation, Gaduk section, NE of Firuz-Kuh, sample. no. Bz. 2524 X75

Fig. 5 *V1a*, Mobarak formation, same locality as fig. 1, sample no. Bz. 2522 X75

Bischaera ovoidea CONIL & LYS

Fig. 3 *V1a*, Mobarak formation, Geirud section, upper Jajrud valley, sample no. Bz. 233 X75

Bischaera malavkensis BIRINA

Fig. 4,6 *V1a*, Mobarak formation, sample no. Bz. 2515 X75

Archaesphaera magna SULEIMANOV

Fig. 7 *Tn2*, Mobarak formation, Khoshyeilagh section, NE of Shahrud, sample no. Me. 943 X180

Archaesphaera minima SULEIMANOV

Fig. 8-9 *Tn2*, Mobarak formation, sample no. Me. 1210 X180

Radiosphaera sp.

Fig. 10 *Tn2*, Mobarak formation, sample no. Me. 921 X120

Eotuberitina reitlingerae MIKLUKO-MAKLAY

Fig. 11 *Tn2*, Mobarak formation, sample no. Me. 959 X140

Diplosphaerina inaequalis (DERVILLE)

Fig. 12 *Tn2*, Mobarak formation, sample no. Me. 959 X140

Earlandia minor (RAUZER-CHERNOUSSOVA)

Fig. 13-14 *Tn2*, Mobarak formation, sample no. Bz. 1287 X50

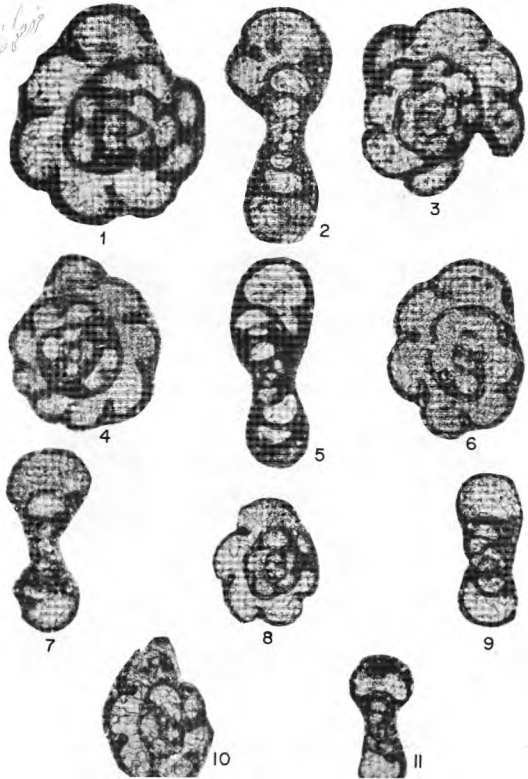
Earlandia elegans (R. CHERN. & REIT.)

Fig. 15 *V1a*, Mobarak formation, sample no. Bz. 1802 X50

Girvanella wetheredi CHAPMAN

Fig. 16 *Tn3*, Mobarak formation, same locality as fig. 1, sample no. Bz. 2486 X110

PLATE IV (2)



EXPLANATION OF PLATE IV

All figured specimens are from Mobarak formation (X70)

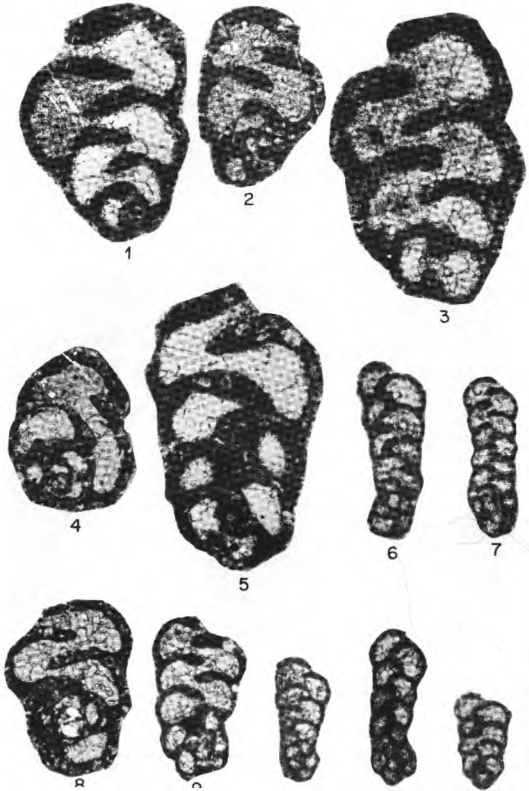
Septabrunsiina kingirica (REITLINGER)

Fig. 1 *Tn3b*, Aruh section, Firuz-Kuh area, sample no. Bz. 1271
Fig. 2,3,5 *Tn3b*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2488
Fig. 4 *Tn3b*, same locality as fig. 1, sample no. Bz. 1276

Septabrunsiina krainica (LIPINA)

Fig. 6,11 *Tn3b*, same locality as fig. 2, sample no. Bz. 2488
Fig. 7,10 *Tn3b*, same locality as fig. 1, sample no. Bz. 1271
Fig. 8 *Tn3b*, same locality as fig. 2, sample no. Bz. 2487
Fig 9 *Tn3b*, same locality as fig. 1, sample no. Bz. 1276

PLATE V



EXPLANATION OF PLATE V

"All figured specimens are from Mobarak formation"
(X70)

Paleospiroplectammina diversa (N. CHERNYSHEVA)

Fig. 1-3,5 *V1a*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2512

Fig. 4,8 *V1a*, same locality as fig. 1, sample no. Bz. 2613

Endospiroplectammina conili LIPINA subsp. *lafoliensis* LIPINA

Fig. 6 *V1a*, same locality as fig. 1, sample no. Bz. 2630

Fig. 7,11 *V1a*, same locality as fig. 1, sample no. Bz. 2611

Paleospiroplectammina mellina (MALAKHOVA) subsp. *claviensis* CONIL & LIPINA

Fig. 9 *V1a*, Aruh section, Firuz-Kuh area, sample no. Bz. 1273

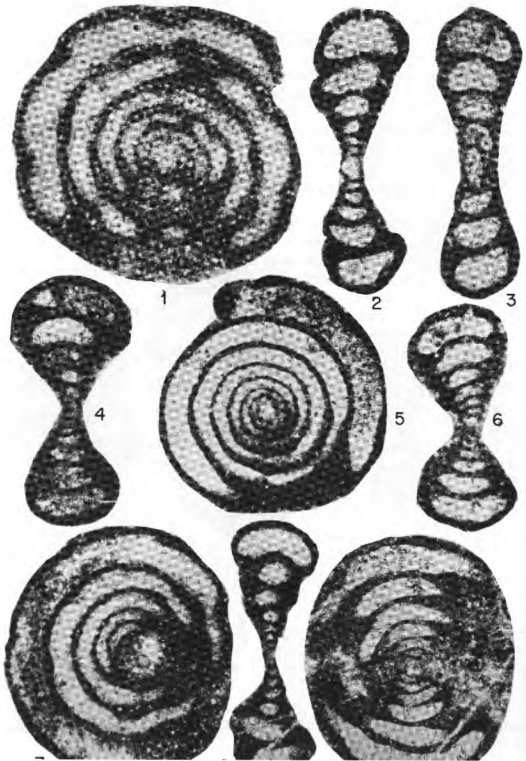
Paleospiroplectammina sinensis LIPINA

Fig. 10 *V1a*, same locality as fig. 1, sample no. Bz. 2547

Paleospiroplectammina guttula (MALAKHOVA)

Fif. 12 *V1a*, same locality as fig. 1, sample no. Bz. 2568

PLATE VI



EXPLANATION OF PLATE VI

"All figured specimens are from Mobarak formation of the Gaduk section, NE of Firuz-Kuh"
(X70)

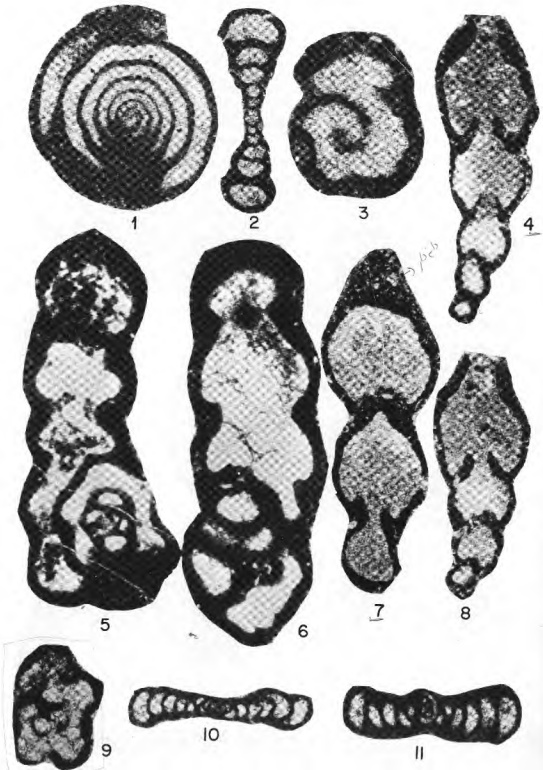
Tournayella gigantea var. *minoris* LIPINA

Fig. 1 *V1a*, sample no. Bz. 2523
Fig. 2,8 *V1a*, sample no. Bz. 2525
Fig. 3 *V1a*, sample no. Bz. 2545

Tournayella moelleri MALAKHOVA

Fig. 4 *V1a*, sample no. Bz. 2525
Fig. 5,6,9 *V1a*, sample no. Bz. 2545
Fig. 7 *V1a*, sample no. Bz. 2539

PLATE VII



EXPLANATION OF PLATE VII

«All figured specimens are from Mobarak formation»

Tournayella discoidea DAIN forma *maxima* DAIN
Fig. 1 *V1a*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2548 X70
Fig. 2 *V1a*, same locality as fig. 1, sample no. Bz. 2545 X70

Tournayellina beata (MALAKHOVA)
Fig. 3 *V1a*, same locality as fig. 1, sample no. Bz. 2567 X70

Darjella monilis MALAKHOVA
Fig. 4,8 *Tn3c*, Aruh section, Firuz-Kuh area, sample no. Bz. 1237 X25
Fig. 7 *V1a*, same locality as fig. 1, sample no. Bz. 2507 X25

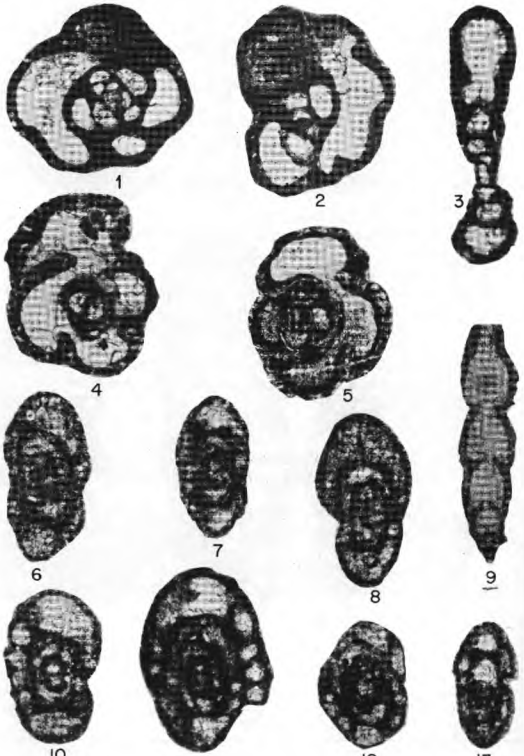
Pseudolituotubella tenuissima (VDOVENKO)
Fig. 5 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 2073 X50
Fig. 6 *V1b*, same locality as fig. 5, sample no. Bz. 1897 X50

Tournayellina pentacamerata BOZORGNIA, nov. sp.
Fig. 9 *V1a*, same locality as fig. 1, sample no. Bz. 2543 X70

Brunsia spirillinoides (GROZD. & GLEB.)
Fig. 10 *V1b*, same locality as fig. 5, sample no. Bz. 1883 X70

Brunsia pulchra MIKHAILOV
Fig. 11 *V1b*, same locality as fig. 5, sample no. Bz. 2115 X70

PLATE VIII



EXPLANATION OF PLATE VIII

«All figured specimens are from Mobarak formation»

Msitinia sp. 1 CONIL & LYS

Fig. 1 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 2099 X50

Pseudolituotubella tenuissima (VDOVENKO)

Fig. 2 *V1b*, same locality as fig. 1, sample no. Bz. 2073 X50

Forschiella prisca MALAKHOVA

Fig. 3 *V1b*, same locality as fig. 1, sample no. Bz. 1852 X50

Mstinia? modavensis CONIL & LYS

Fig. 4 *V1a*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2515 X70

Fig. 5 *V1a*, same locality as fig. 4, sample no. Bz. 2611 X70

Eoparastaffella simplex VDOVENKO forma *typica*.

Fig. 6-7 *V1a*, same locality as fig. 4, sample no. Bz. 2600 X70

Fig. 13 *V1a*, same locality as fig. 4, sample no. Bz. 2613 X70

Darjella parvula BOZORGNIA, nov. sp.

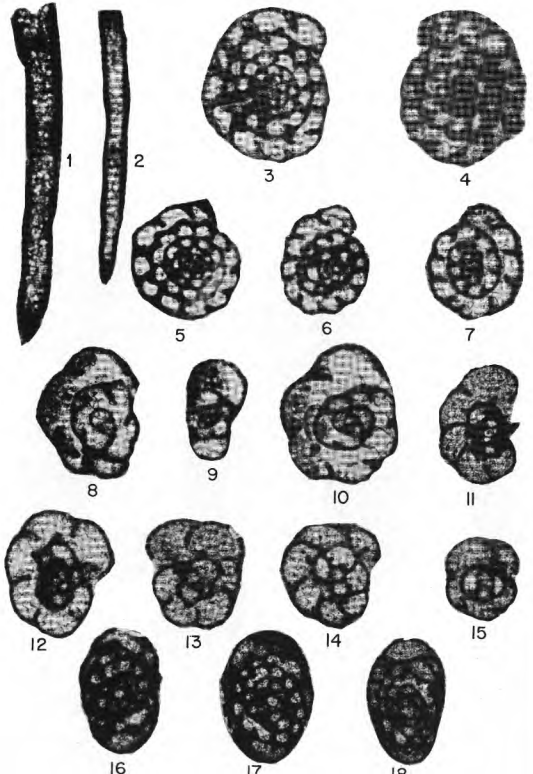
Fig. 9 *V1a*, same locality as fig. 4, sample no. Bz. 2568 X110

Eoparastaffella simplex VDOVENKO forma *ovalis*.

Fig. 8,10,11 *V1a*, same locality as fig. 4, sample no. Bz. 2600 X70

Fig. 12 *V1a*, same locality ls fig. 4, sample no. Bz. 2605 X70

PLATE IX



EXPLANATION OF PLATE IX

"All figured specimens are from Mobarak formation"

Earlandia vulgaris (R. CHER. & REIT.)

Fig. 1 *V1a*, Geirud section, upper Jajrud valley, sample no. Bz. 247 X50

Earlandia minor (RAUZER-CHERNOUSSOVA)

Fig. 2 *V1a*, Aruh section, Firuz-Kuh area, sample no. Bz. 1307 X50

Endothyra recta LIPINA

Fig. 3,5 *V1a*, Abnak section, upper Jajrud valley, sample no. Bz. 2099 X70

Fig. 4,6 *V1a*, Gaduk section, NE of Firuz-Kuh, sample. no. Bz. 2547 X70

Endothyra inflata LIPINA

Fig. 7 *V1a*, same locality as fig. 3, sample no. Bz. 2106 X70

Endothyra laxa (CONIL & LYS)

Fig. 8-10 *V1a*, same locality as fig. 4, sample no. Bz. 2545 X70

Fig. 15 *V1a*, same locality as fig. 4, sample no. Bz. 2600 X70

Endothyra paraukrainica LIPINA

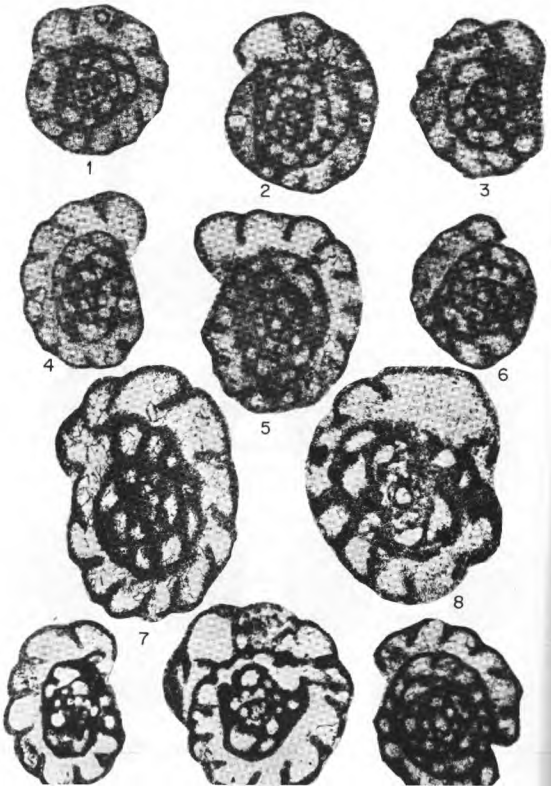
Fig.11,13,14 *V1a*, Dozdehband section, N of Kandevan pass, sample no. Bz. 2804 X70

Fig. 12 *V1a*, same locality as fig. 3, sample no. Bz. 1848 X70

Dainella chomatica (DAIN) forma *typica* BRADZH.

Fig. 16-18 *V1a*, same locality as fig. 4, sample no. Bz. 2618 X70

PLATE X (10)



EXPLANATION OF PLATE X

Endothyra stricta (CONIL & LYS)

Fig. 1 *V1a*, Mobarak formation, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2548 X70

Fig.2,4-6,11 *V1a*, Mobarak formation, same locality as fig. 1, sample no. Bz. 2600 X70

Fig. 3 *V1a*, Mobarak formation, same locality as fig. 1, sample no. Bz. 2559 X70

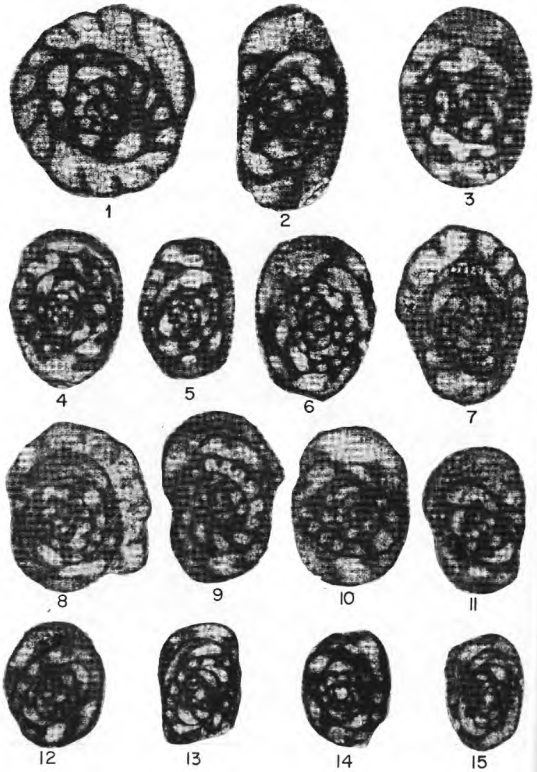
Fig. 7 *V1*, Spa 3/2, R-5247 X75

Fig. 8 *V1*, Notoye 22/8, R-5258 X75

Fig. 9 *V1a*, Notoye 20/310, R-2509 X75

Fig. 10 *V1a*, Notoye, R-3504 X75

PLATE XI (11)



EXPLANATION OF PLATE XI

"All figured specimens are from Mobarak formation of the Gaduk section, NE of Firuz-Kuh"
(X70)

Dainella chomatica (DAIN) forma *magna* BRADZHN.
Fig. 1 *V1a*, sample no. Bz. 2606
Fig. 2 *V1a*, sample no. Bz. 2617

Dainella alborzensis BOZORGNIA, nov. sp.
Fig. 3 *V1a*, sample no. Bz. 2600
Fig. 4 *V1a*, sample no. Bz. 2608 (*HOLOTYPE*)
Fig. 5-6 *V1a*, sample no. Bz. 2610

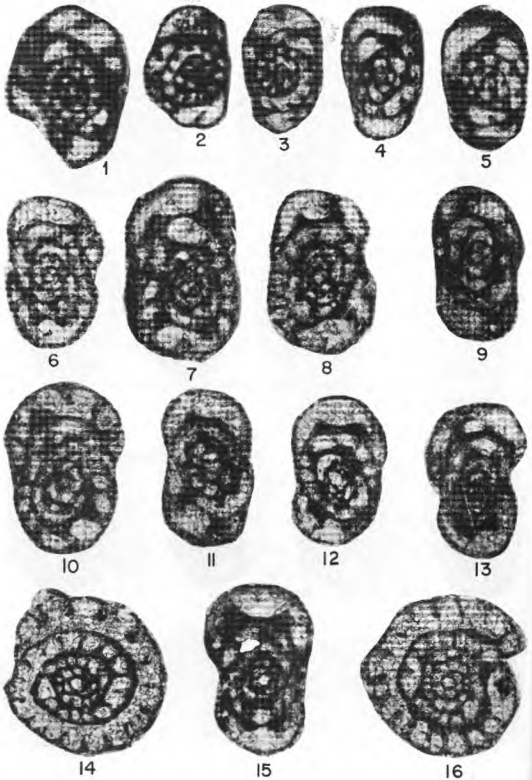
Dainella densaspira BOZORGNIA, nov. sp.
Fig. 7-8 *V1a*, sample no. Bz. 2620 (fig. 8, *HOLOTYPE*)

Dainella elegantula BRADZHNIKOVA forma *typica*
Fig. 9-10 *V1a*, sample no. Bz. 2628
Fig. 12 *V1a*, sample no. Bz. 2628

Dainella elegantula BRADZH. forma *ventrosa*
Fig. 11 *V1a*, sample no. Bz. 2592

Dainella chomatica (DAIN) forma *staffelloides* BRADZNIKOVA
Fig. 13 *V1a*, sample no. Bz. 2697
Fig. 14 *V1a*, sample no. Bz. 2611
Fig. 15 *V1a*, sample no. Bz. 2609

PLATE XII



EXPLANATION OF PLATE XII

"All figured specimens are from Mobarak formation of the Gaduk section, NE of Firuz-Kuh"
(X70)

Dainella exuberans (CONIL & LYS)
Fig. 1 *V1a*, sample no. Bz. 2600

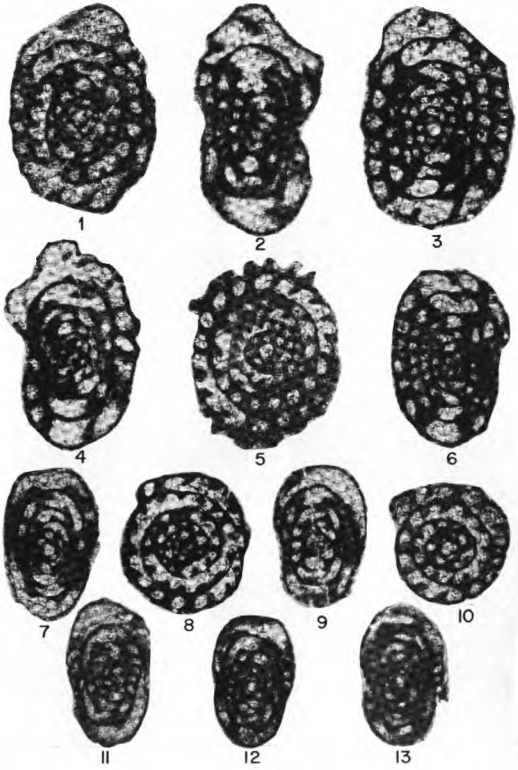
Dainella fleronensis (CONIL & LYS)
Fig. 2 *V1a*, sample no Bz. 2600
Fig. 3 *V1a*, sample no. Bz. 2606

Dainella sp. cf. *D. fleronensis* (CONIL & LYS)
Fig. 4-5 *V1a*, sample no. Bz. 2533

Dainella tumultuosa BOZORGNIA, nov. sp.
Fig. 6,10-12 *V1a*, sample no. Bz. 2613
Fig. 7-8 *V1a*, sample no. Bz. 2604 (fig. 8, *HOLOTYPE*)
Fig. 9 *V1a*, sample no. Bz. 2608

Lysella umbilicata BOZORGNIA, nov. sp.
Fig. 13,15 *V1a*, sample no. Bz. 2604 (fig. 15, *HOLOTYPE*)
Fig. 14 *V1a*, sample no. Bz. 2608
Fig. 16 *V1a*, sample no. Bz. 2613

PLATE XIII (۱۳)



EXPLANATION OF PLATE XIII

"All figured specimens are from Mobarak formation of the Gaduk section, NE of Firuz-Kuh"
(X70)

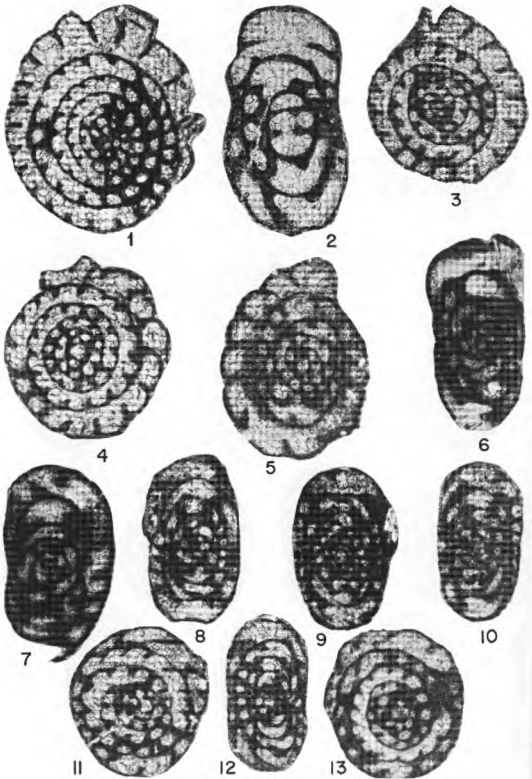
Lysella crassisepta BOZORGNIA, nov. sp.

Fig. 1 *V1a*, sample no. Bz. 2605
Fig. 2,5-6 *V1a*, sample no. Bz. 2604
Fig. 3-4 *V1a*, sample no. Bz. 2613 (fig. 3, *HOLOTYPE*)

Lysella schubertelloides BOZORGNIA, nov. sp.

Fig. 7 *V1a*, sample no. Bz. 2604 *(HOLOTYPE)*
Fig. 8,12 *V1a*, sample no. Bz. 2607
Fig. 9,11 *V1a*, sample no. Bz. 2613
Fig. 10 *V1a*, sample no. Bz. 2605
Fig. 13 *V1a*, sample no. Bz. 2612

PLATE XIV



EXPLANATION OF PLATE XIV

"All figured specimens are from Mobarak formation of the Gaduk section, NE of Firuz-Kuh"
(X70)

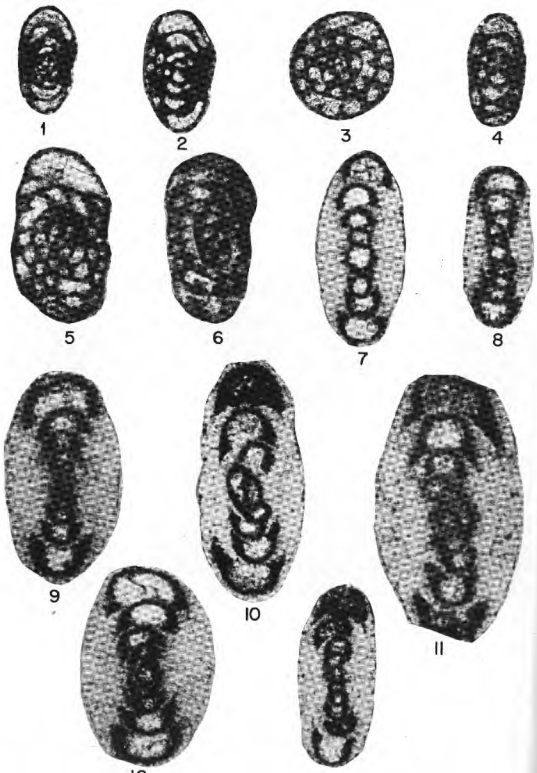
Lysella multicamerata BOZORGNIA, nov. sp.
Fig. 1-2 *V1a*, sample no. Bz. 2613 (fig. 1, *HOLOTYPE*)

Lysella scitula BOZORGNIA, nov. sp.
Fig. 3-4 *V1a, sample no. Bz. 2613 (fig. 4, HOLOTYPE)*

Lysella gadukensis BOZORGNIA, nov. sp.
Fig. 5-7 *V1a*, sample no. Bz. 2602 (fig. 5, *HOLOTYPE*)

Lysella conferta BOZORGNIA, nov. sp.
Fig. 8-10 *V1a*, sample no. Bz. 2604 (fig. 8, *HOLOTYPE*)
Fig. 11 *V1a*, sample no. Bz. 2613
Fig. 12-13 *V1a*, sample no. Bz. 2607

PLATE XV (12)



EXPLANATION OF PLATE XV

"All figured specimens are from Mobarak formation"

Lysella mediocriformis BOZORGNIA, nov. sp.
Fig. 1 *V1a*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2607 X70
Fig. 2 *V1a*, same locality as fig. 1, sample no. Bz. 2613 *(HOLOTYPE)* X70
Fig. 3 *V1a*, same locality as fig. 1, sample no. Bz. 2605 X70
Fig. 4 *V1a*, same locality as fig. 1, sample no. Bz. 2608 X70

Quasiendothyra sp.
Fig. 5-6 *V1a*, same locality as fig. 1, sample no. Bz. 2620 X70

Archaediscus (Permodiscus) sp. 1, nov. sp.
Fig. 7 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 1829 X140

Archaediscus (Paraarchaediscus) rigens (C. & L.)
Fig. 8 *V1b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3971 X140

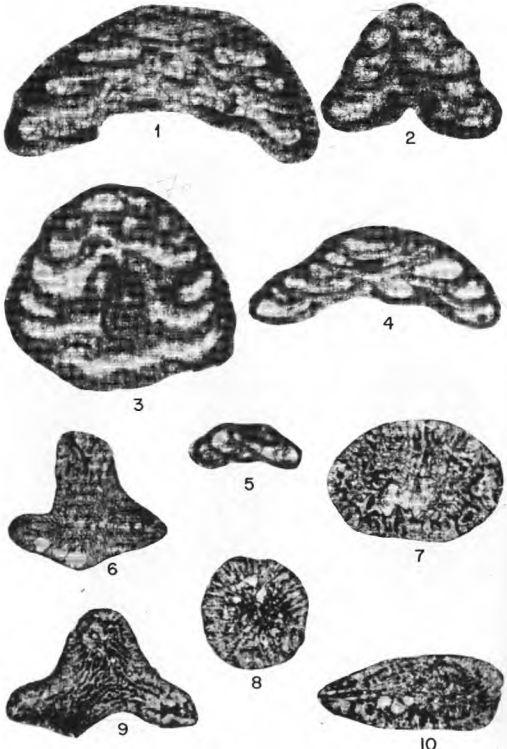
Archaediscus (Permodiscus) rotundus. N. CHERN. var. *inflatus* CONIL & LYS
Fig. 9 *V1b*, same locality as fig. 7, sample no. Bz. 1880 X140
Fig. 12 *V1b*, same locality as fig. 7, sample no. Bz. 2071 X140

Archaediscus (Paraarchaediscus) mixtus (C. & L.)
Fig. 10 *V1b*, same locality as fig. 8, sample no. Bz. 3965 X140

Archaediscus (Paraarchaediscus) lenitortus (C. & L.)
Fig. 11 *V1b*, same locality as fig. 7, sample no. Bz. 1775 X140

Archaediscus (Permodiscus) rotundus N. CHERN. var. *elongatus* CONIL & LYS
Fig. 13 *V1b*, same locality as fig. 8, sample no. Bz. 2967 X140

PLATE XVI (17)



EXPLANATION OF PLATE XVI

"All figured specimens are from Mobarak formation"

Tetrataxis hemisphaerica MOROZOVA

Fig. 1 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 2147 X48

Tetrataxis conica EHRENBERG

Fig. 2 *V1a*, Gaduk section, 25km. NE of Firuz-Kuh, sample no. Bz. 2512 X48

Tetrataxis hemisphaerica var. *elongata* MOROZOVA

Fig. 3 *V1a*, Mobarak Abad section, NE of Abe-Ali, sample no. Bz. 470 X54

Tetrataxis planulata MOROZOVA

Fig. 4 *V1a*, same locality as fig. 3, sample no. Bz. 504 X54

Tetrataxis sp.

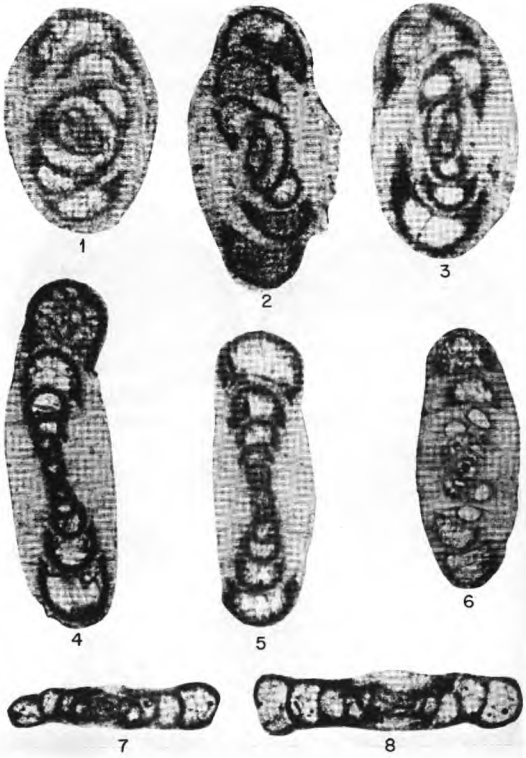
Fig. 5 *V1a*, same locality as fig. 1, sample no. Bz. 1898 X54

Aoujgalia? sp.

Fig. 6-7 *V1b*, same locality as fig. 1, sample no. Bz. 1798 X30

Fig. 8-10 *V1b*, same locality as fig. 1, sample no. Bz. 1882 X30

PLATE XVII (V)



EXPLANATION OF PLATE XVII

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Paraarchaediscus) preconvexus BOZORGNIA, nov. sp.

Fig. 1 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 1854

Archaediscus (Paraarchaediscus) mixtus (C. & L.)

Fig. 2 *V2a*, Dozdehband section, N of Kandevan pass, sample no. Bz. 3804

Archaediscus (Paraarchaediscus) miloni PELHATE

Fig. 3 *V1b*, same locality as fig. 1, sample no. Bz. 1775

Archaediscus (Permodiscus) abnakensis BOZORG. n. sp.

Fig. 4 *V1b*, same locality as fig. 1, sample no. Bz. 2071 (*HOLOTYPE*)

Fig. 5 *V1b*, same locality as fig. 1, sample no. Bz. 1864

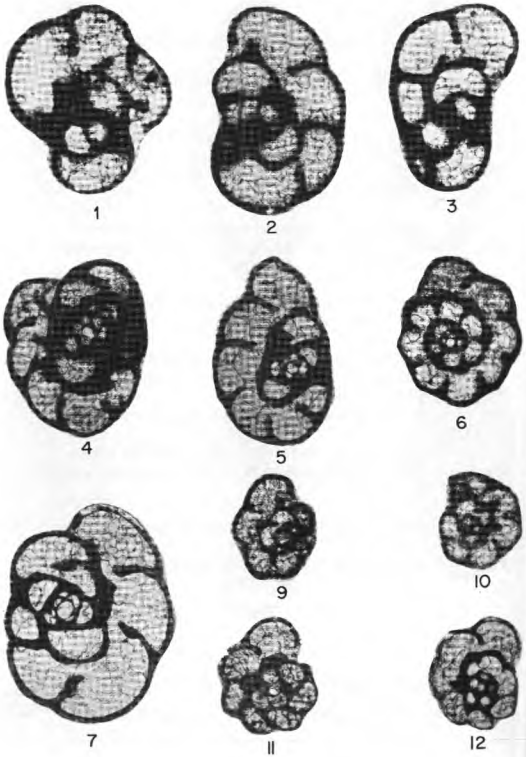
Archaediscus (Archaediscus) stilus GROZD. & LEB.

Fig. 6 *V2b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3507

Archaediscus (Planoarchaediscus) eospirillinoides BRADZNIKOVA

Fig. 7-8 *V2b*, same locality as fig. 2, sample no. Bz. 3858

PLATE XVIII (18)



EXPLANATION OF PLATE XVIII

"All figured specimens are from Mobarak formation"
(X70)

Endothyra apposita GANELINA

Fig. 1,3 *V1b*, Abnak section, upper Jajrud valley, sample no. Bz. 1848

Fig. 2 *V2a*, Valiabad section, N of Kandevan pass, sample no. Bz. 3484

Fig. 4,5,7 *V2b*, same locality as fig. 2, sample no. Bz. 3492

Endothyra bradyi MIKHAILOV

Fig. 6 *V1b*, same locality as fig. 1, sample no. Bz. 1809

Endothyra acantha CONIL & LYS

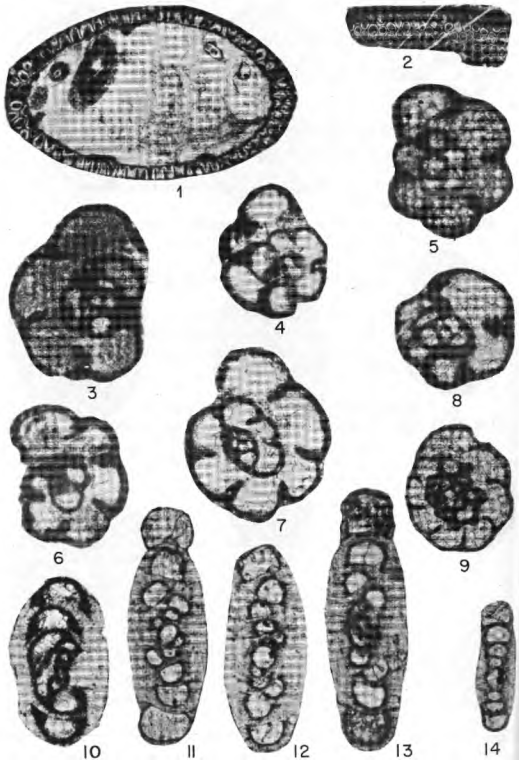
Fig. 8 *V1b*, same locality as fig. 1, sample no. Bz. 1845

Fig. 9 *V2b*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2627

Endothyra sp. aff. *E. tuberculata* LIPINA

Fig. 10-11 *V2b*, same locality as fig. 2, sample no. Bz. 3507

PLATE XIX (14)



EXPLANATION OF PLATE XIX

"All figured specimens are from Mobarak formation"

Koninckopora minuta WEYER

Fig. 1-2 *V3a*, Chaboksar section, 16km. of Ramsar, sample no. Bz. 3388 X24

Endothyra convexa RAUZER-CHERNOUSSOVA subsp. *exelikta* CONIL & LYS

Fig. 3,6,8 *V2a*, Abnak section, upper Jajrud valley, sample no. Bz. 2106 X70

Fig. 4 *V2a*, same locality as fig. 3, sample no. Bz. 2091 X70

Fig. 5 *V1b*, same locality as fig. 3, sample no. Bz. 1845 X70

Endothyra sp. aff. *E. convexa* R. CHERN.

Fig. 7 *V2a*, same locality as fig. 3, sample no. Bz. 2106 X70

Endothyra sp. aff. *E. tuberculata* LIPINA

Fig. 9 *V2a*, Gaduk section, NW of Firuz-Kuh, sample no. Bz. 2613 X70

Archaediscus (Paraarchaediscus) cf. P. *mixtus* C. & L.

Fig. 10 *V2a*, Valiabad section, N of Kandevan pass, sample no. Bz. 3967 X140

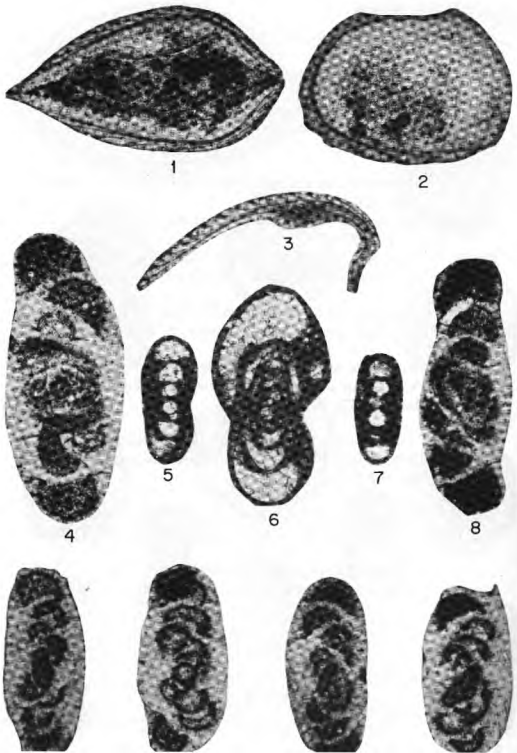
Archaediscus (Archaediscus) stilus GROZD. & LEB.

Fig. 11-13 *V2a*, same locality as fig. 10, sample no. Bz. 3943 X140

Archaediscus (Planoarchaediscus) sp.

Fig. 14 *V2a*, same locality as fig. 10, sample no. Bz. 3482 X140

PLATE XX



EXPLANATION OF PLATE XX

"All figured specimens are from Mobarak formation"

Crypotophyllus sp.

Fig. 1-3 *V3a*, Valiabad section, N of Kandevan pass, sample no. Bz. 3515 X75

Archaediscus (Rugosoarchaediscus) sp.

Fig. 4 *V3c*, Dozdehban section, N of Kandevan pass, sample no. Bz. 2824 X140

Fig. 8 *V3a*, same locality as fig. 1, sample no. Bz. 3512 X140

Mediocris breviscula (GANELINA)

Fig. 5,7 *V2a*, Abnak section, upper Jajrud valley, sample no. Bz. 1851 X70

Eostaffella parastruvei R. CHERN.

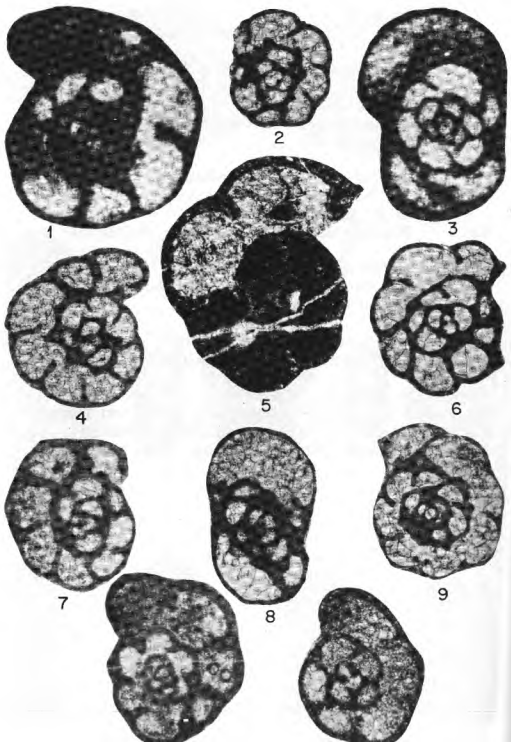
Fig. 6 *V2b*, same locality as fig. 1, sample no. Bz. 3487 X70

Archaediscus (Rugosoarchaediscus) cornua C. & L.

Fig. 9 *V2b*, same locality as fig. 1, sample no. Bz. 3491 X140

Fig. 10 *V3a*, same locality as fig. 1, sample no. Bz. 3527 X140

Fig. 11-12 *V2b*, same locality as fig. 1, sample no. Bz. 3485 X140



EXPLANATION OF PLATE XXI

"All figured specimens are from Mobarak formation"
(X70)

Endothyra omphalota RAUZER-CHERNOUSSOVA & REITLINGER var. *minima* R. CHERN. & REIT.

Fig. 1,3 *V3a*, Chaboksar section, 16km. W of Ramsar, sample no. Bz. 3388

Endothyra omphalota RAUZER-CHERNOUSSOVA & REITLINGER var. *parvula* BOZORGNIA, nov. var.

Fig. 2,4,7 *V2a*, Gaduk section, NE of Firuz-Kuh, sample no. Bz. 2613 (fig. 4, *HOLOTYPE)*

Fig. 6,8,9 *V2b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3492

Endothyranopsis? sp.

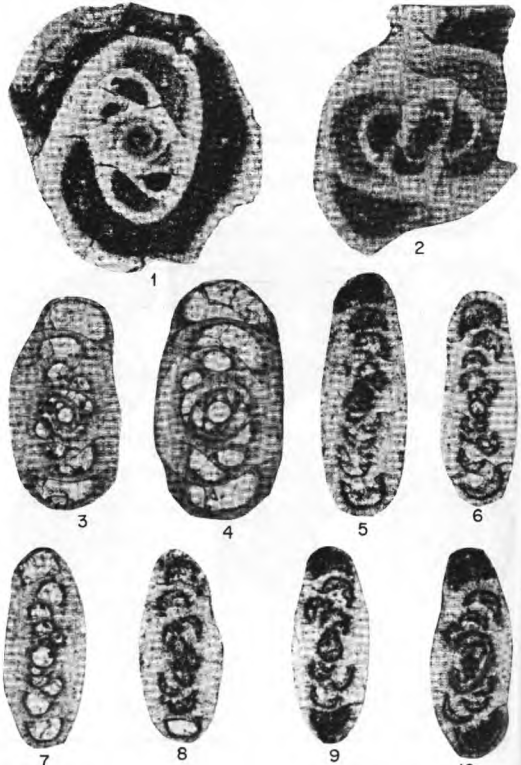
Fig. 5 *V3c*, Dozdehband section, N of Kandevan pass, sample no. Bz. 3824

Endothyra convexa RAUZER-CHERNOUSSOVA subsp. *regularis* RAUZER-CHERNOUSSOVA

Fig. 10 *V2a*, Abnak section, upper Jajrud valley, sample no. Bz. 2106

Fig. 11 *V3a*, same locality as fig. 1, sample no. Bz. 3397

PLATE XXII



EXPLANATION OF PLATE XXII

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Archaediscus) moelleri R. CHERN.
Fig. 1 *V3b,* Chaboksar section, 16km. W of Ramsar, sample no. Bz. 3405

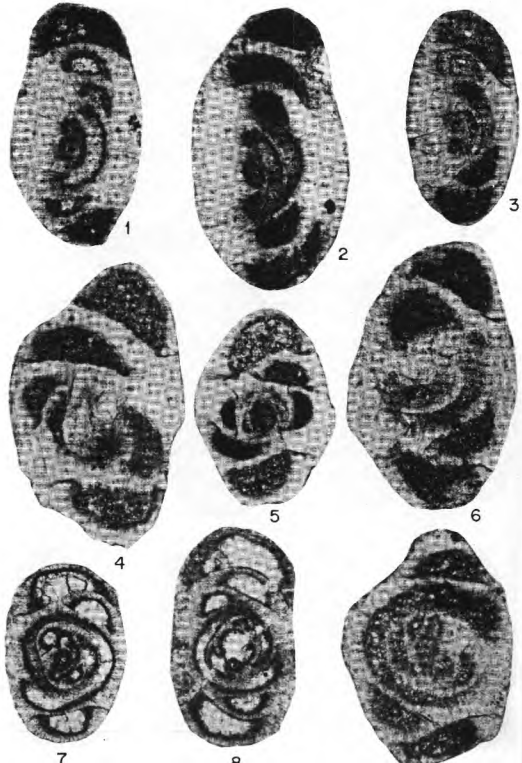
Archaediscus (Archaediscus) crux CONIL & LYS
Fig. 2 *V3b,* same locality as fig. 1, sample no. Bz. 3405

Archaediscus (Archaediscus) krestovnikovi var. *krestovnikovi* R. CHERN.
Fig. 3 *V2b,* Valiabad section, N of Kandevan pass, sample no. Bz. 3492
Fig. 4 *V2b,* same locality as fig. 3, sample no. Bz. 3507

Archaediscus (Rugosoarchaediscus) demaneti C. & L.
Fig.5-6,8-10 *V2b,* same locality as fig. 3, sample no. Bz. 3485

Archaediscus (Archaediscus) stilus GROZD. & LEB.
Fig. 7 *V2b,* same locality as fig. 3, sample no. Bz. 3494

PLATE XXIII



EXPLANATION OF PLATE XXIII

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Archaediscus) pulvinus C. & L.

Fig. 1-2 *V2b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3491

Fig. 3 ***V3a,*** same locality as fig. 1, sample no. Bz. 3511

Archaediscus (Archaediscus) moelleri RAUZER-CHERNOUSSOVA var. *gigas* R. CHERN.

Fig. 4,6 *V3b*, Chaboksar section, 16km. W of Ramsar, sample no. Bz. 3405

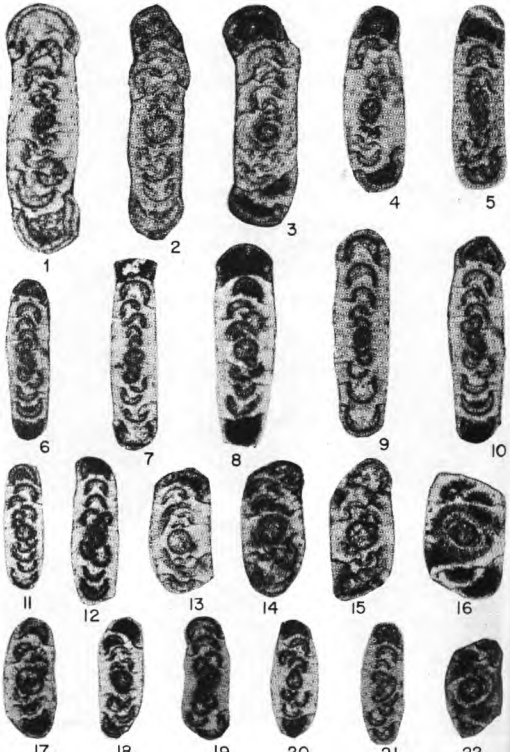
Fig. 5 ***V3b,*** same locality as fig. 4, sample no. Bz. 3394

Archaediscus (Archaediscus) convexus GROZD. & LEB

Fig. 7-8 ***V2b,*** same locality as fig. 1, sample no. Bz. 3493

Fig. 9 ***V3b,*** same locality as fig. 4, sample no. Bz. 3394

PLATE XXIV



EXPLANATION OF PLATE XXIV

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Neoarchaediscus) pirleti BOZORGNIA, **nov. sp.**

Fig. 1 — *V3c*, Dozdehban section, sample no. Bz. 3867
Fig. 2,3,5 — *V3c*, same locality as fig. 1, sample no. Bz. 2824 (fig. 2, *HOLOTYPE*)
Fig. 4 — *V3b*, Chaboksar section, W of Ramsar sample no. Bz. 3396

Archaediscus (Neoarchaediscus) planus BOZORGNIA, **nov. sp.**

Fig. 6,10-12 — ***V3c***, same locality as fig. 1, sample no. Bz. 3824
Fig. 7-8 — ***V3c***, same locality as fig. 1, sample no. Bz. 3857
Fig. 9 — ***V3b***, same locality as fig. 4, sample no. Bz. 3397 (*HOLOTYPE*)

Archaediscus (Neoarchaediscus) rostratus BOZORGNIA, **nov. sp.**

Fig. 13-14 — *V3c*, same locality as fig. 1, sample no. Bz. 3824
Fig. 15 — ***V3c***, same locality as fig. 1, sample no. Bz. 3857 (*HOLOTYPE*)

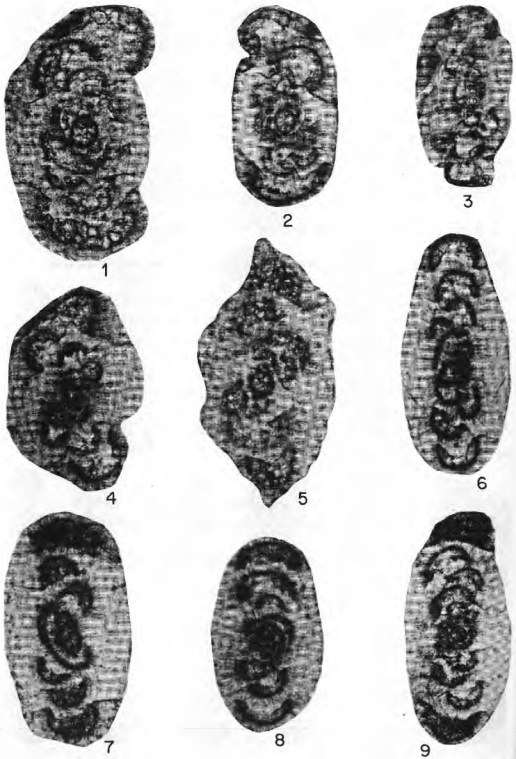
Archaediscus (Archaediscus) macer CONIL & LYS

Fig. 16,22 — ***V3c***, same locality as fig. 1, sample no. Bz. 3857

Archaediscus (Neoarchaediscus) exiguus BOZORGNIA **nov. sp.**

Fig. 17-19 — ***V3c***, same locality as fig. 1, sample no. Bz. 3824
Fig. 20-21 — *V2b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3485 (fig. 21, *HOLOTYPE*)

PLATE XXV



EXPLANATION OF PLATE XXV

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Rugosoarchaediscus) conili BOZORGNIA, nov. sp.

Fig. 1 *V3b*, Chaboksar section, W of Ramsar, sample no. Bz. 3397
Fig. 2 *V2b*, Valiabad section, N of Kandevan pass, sample no. Bz. 3507 (*HOLOTYPE*)
Fig. 3 *V3a*, Dozdehband section, N of Kandevan pass, sample no. Bz. 3857

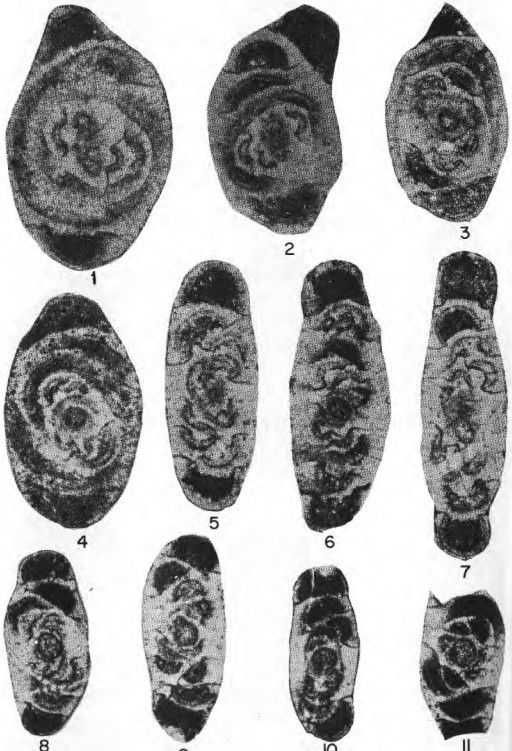
Archaediscus (Rugosoarchaediscus) karreriformis REIT.

Fig. 4-5 *V3b*, same locality as fig. 1, sample no. Bz. 3401

Archaediscus (Rugosoarchaediscus) tchalussensis BOZORGNIA, nov. sp.

Fig. 6 *V2b*, same locality as fig. 3, sample no. Bz. 3409 (*HOLOTYPE*)
Fig. 7 *V2b*, same locality as fig. 2, sample no. Bz. 3485
Fig. 8-9 *V3b*, same locality as fig. 1, sample no. Bz. 3392

PLATE XXVI



EXPLANATION OF PLATE XXVI

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Rugosoarchaediscus) stellatus
BOZORGNIA, nov. sp.

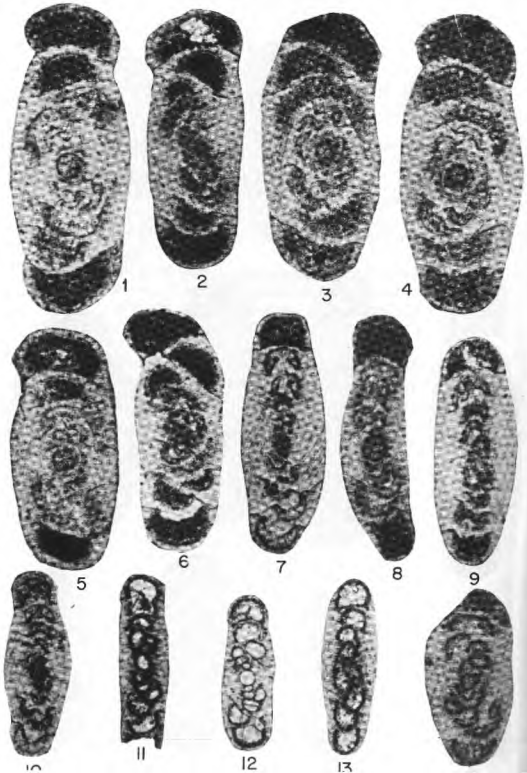
Fig. 1 *V3b*, Chaboksar section, 16km. W of Ramsar, sample no. Bz. 3404 (*HOLOTYPE*)
Fig. 2-3 *V3b*, same locality as fig. 1, sample no. Bz. 3394
Fig. 4 *V3c*, Valiabad section, sample no. Bz. 3824

Archaediscus (Rugosoarchaediscus) latispiralis
GROZDILOVA & LEBEDEVA var. 1, nov. var.

Fig. 5,7 *V3c*, Dozdehband section, sample no. Bz. 3824
Fig. 6 *V3b*, same locality as fig. 1, sample no. Bz. 3394

Archaediscus (Rugosoarchaediscus) mutans CONIL & LYS
Fig. 8-11 *V3b*, same locality as fig. 5, sample no. Bz. 3857

PLATE XXVII (XV)



EXPLANATION OF PLATE XXVII

"All figured specimens are from Mobarak formation"
(X140)

Archaediscus (Rugosoarchaediscus) latispiralis GROZDILOVA & LEBEDEVA

Fig. 1-6 *V3c*, Dozdehban section, N of Kandevan pass, sample no. Bz. 3824

Archaediscus (Rugosoarchaediscus) tchaboksarensis BOZORGNIA, nov. sp.

Fig. 7 *V3b*, Chaboksar section, W of Ramsar, sample no. Bz. 3397 *(HOLOTYPE)*

Fig. 8 *V3c*, Dozdehband section, N of Kanudevan pass, sample no. Bz. 3834

Fig. 9 *V3c*, same locality as fig. 8, sample no. Bz. 3857

Fig. 10 *V3b*, same locality as fig. 7, sample no. Bz. 3394

Archaediscus (Archaediscus) stilus GROZDILOVA & LEBEDEVA var. *piesis* CONIL & LYS

Fig. 11 *V3c*, same locality as fig. 8, sample no. Bz. 3824

Fig. 12-13 *V3c*, same locality as fig. 8, sample no. Bz. 3882

Archaediscus (Rugosoarchaediscus) cornua C. & L.

Fig. 14 *V3b*, same locality as fig. 8, sample no. Bz. 3821

PLATE XXVIII (٢٨)

EXPLANATION OF PLATE XXVIII

"All figured specimens are from Mobarak formation of the Chaboksar section, W of Ramsar"
(X140)

Archaediscus (Rugosoarchaediscus) permodiscoides REITLINGER

Fig. 1,2,4 *V3b*, sample no. Bz. 3394
Fig. 7-12 *V3c*, sample no. Bz. 3396

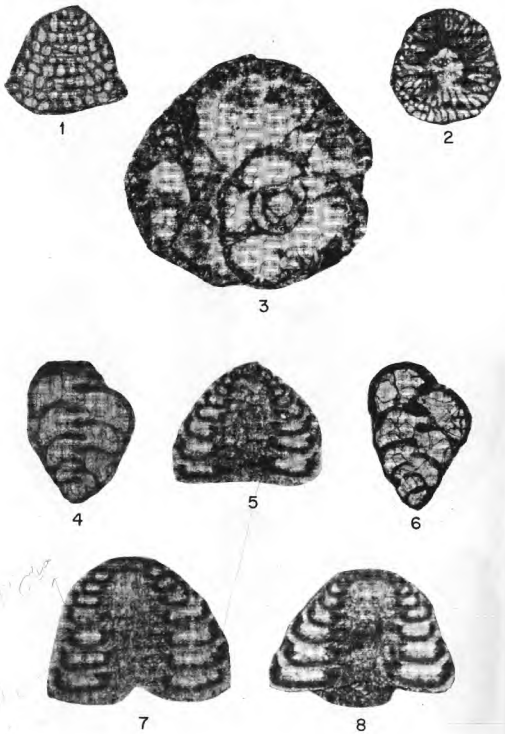
Archaediscus (Rugosoarchaediscus) reditus C. & L.

Fig. 3 *V3c*, sample no. Bz. 3396

Archaediscus (Rugosoarchaediscus) dissolutus BOZORGNIA, nov. sp.

Fig. 5 *V3b*, sample no. Bz. 3397
Fig. 6 *V3b*, sample no. Bz. 3405

PLATE XXIX



EXPLANATION OF PLATE XXIX

"All figured specimens are from Mobarak formation"

Valvulinella youngi (BRADY)

Fig. 1-2 *V2b*, Harijar section, sample no. Bz. 3492 X70

Bradyina lucida MOROZOVA

Fig. 3 *V3b*, Chaboksar section, W of Ramsar, sample no. Hb. 5723 X50

Textularia lipinae (CONIL & LYS)

Fig. 4 *V2b*, same locality as fig. 1, sample no. Bz. 3484 X70

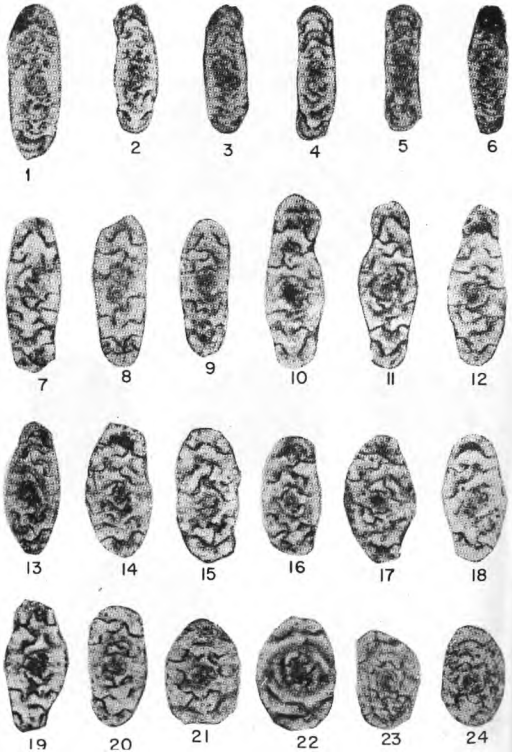
Fig. 6 *V3a*, Dozdehband section, N of Kandevan pass, sample no. Bz. 3854 X70

Howchinia gibba (MOELLER)

Fig. 5,8 *V3b*, Chaboksar section, W of Ramsar, sample no. Hb. 5723 X140

Fig. 7 *V3b*, same locality as fig. 5, sample no. Bz. 3405 X140

PLATE XXX



EXPLANATION OF PLATE XXX

"All samples are from Dozdehband section, N of Kandevan pass"

(X140)

Archaediscus (Neoarchaediscus) incertus GROZD. & LEB.

Fig. 1-2,4-6 *V3c*, Mobarak formation, sample no. Bz. 3824

Fig. 3 *Lower* Namurian, Dozdehband formation, sample no. Bz. 3930

Archaediscus (Neoarchaediscus) gregorii DAIN

Fig. 7,9 *Lower Namurian*, Dozdehband formation, sample no. Bz. 3918

Fig. 8 *Lower Namurian*, Dozdehband formation, sample no. Bz. 3916

Archaediscus (Asteroarchaediscus) postrugosus REIT.

Fig. 10-13,19 *Lower Namurian*, Dozdehband formation, sample no. Bz. 3918

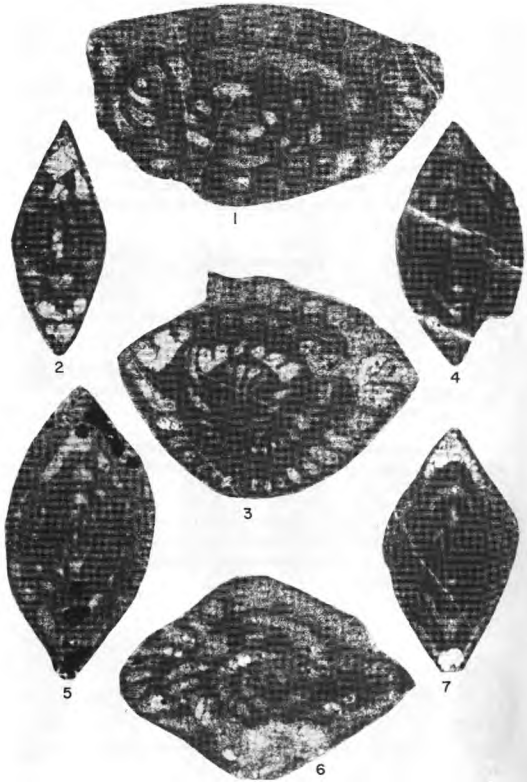
Archaediscus (Asteroarchaediscus) rugosus R. CHER.

Fig. 14-16, 18, 20 *Lower Namurian*, Dozdehband formation, sample no. Bz. 3918

Archaediscus (Asteroarchaediscus) baschkiricus KRESTOVNIKOV & THEODOROVICH

Fig.17,21-24 *Lower Namurian*, Dozdehband formation, sample no. Bz. 3919

PLATE XXXI



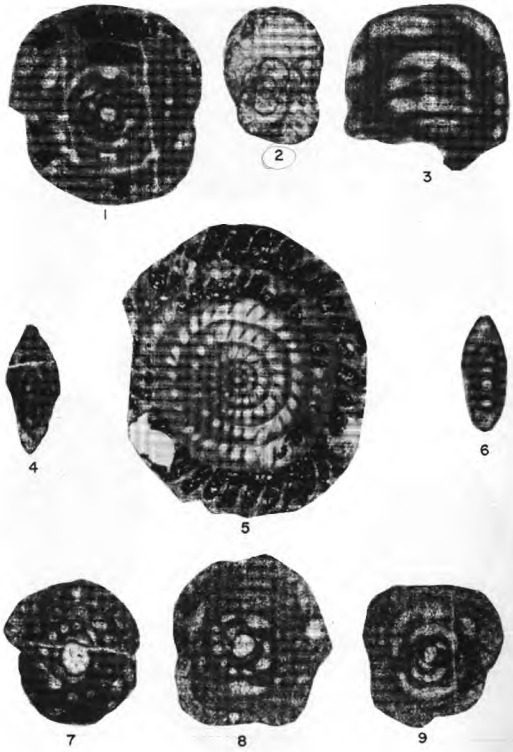
EXPLANATION OF PLATE XXXI

"All figured specimens are from lower Moscovian of the Now-Deh region, in Shahpasand area, sample no. Hb. 2597"
(X70)

Fig. 1,6 *Fusulinella* sp.

Fig. 2-5,7 *Ozawainella sp.*

PLATE XXXII



EXPLANATION OF PLATE XXXII

"All figured specimens are from lower Moscovian of the Now-Deh region, in Shahpasand area, sample no. Hb. 2597"

(X70)

Fig. 1,3 *Pseudostaffella* sp. 1

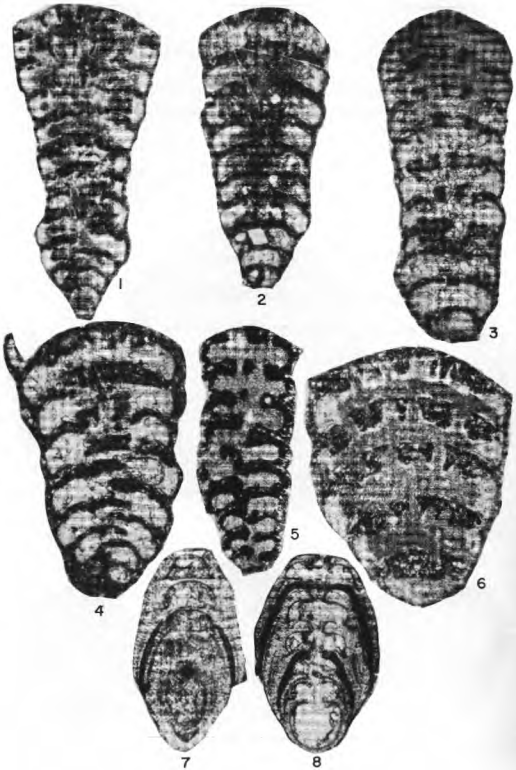
Fig. 2 *Bradyina* sp.

Fig. 4,6 *Millerella* sp.

Fig. 5 *Ozawainella* sp.

Fig. 7-9 *Pseudostaffella* sp. 2

PLATE XXXIII



EXPLANATION OF PLATE XXXIII

Climacammina valvulinoides LANGE
Fig. 1 *Murghabian*, Ruteh formation type section, sample no. Bz. 708 X25

Climacammina major MOROZOVA
Fig. 2,3 *Murghabian*, Nessen formation, section W of Elika valley, sample no. Bz. 1759 X37

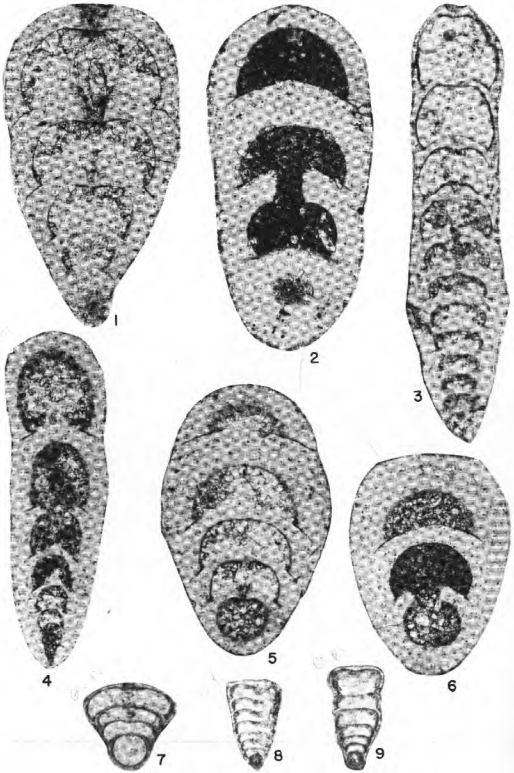
Climacammina moelleri REITLINGER
Fig. 4 *Murghabian*, Ruteh formation, Aruh section, Firuz-Kuh area, sample no. Bz. 1050 X37

Deckerella sp.
Fig. 5 *Murghabian*, Nessen formation, same locality as fig. 2, sample no. Bz. 880 X40

Cribrogenerina sumatrana (VOLZ)
Fig. 6 *Murghabian*, Ruteh formation, same locality as fig. 4, sample no. Bz. 1088 X37

Fig. 7,8 *Cryptoseptida anatoliensis* DE CIVRIEUX & DESS.
Fig. 7,8 *Julfian*, Nessen formation, same locality as fig. 2, sample no. Bz. 893 X110

PLATE XXXIV



EXPLANATION OF PLATE XXXIV

Langella conica DE CIVRIEUX & DESS.

Fig. 1 *Upper Murghabian*, Ruteh formation type section, sample no. Bz. 708 X90

Langella perforata (LANGE)

Fig. 2 *Lower* Murghabian, Ruteh formation, same locality as fig. 1, sample no. Bz. 737 X90

Fig. 5-6 *Murghabian*, same locality as fig. 1, sample no. Bz. 750 X90

Langella sp. 1

Fig. 3 *Murghabian*, Ruteh formation, Aruh section, Firuz-Kuh area, sample no. Bz. 1131 X90

Langella ocarina S.DE CIVRIEUX & DESSAUVAGIE

Fig. 4 *Murghabian*, Ruteh formation, Gaduk section, NE of Firuz-Kuh sample no. Bz. 2886 X90

Geinitzina primitiva POTIEVSKAIA

Fig. 7 *Julfian*, Nessen formation type section, N of Kandevan pass, sample no. Bz. 883 X90

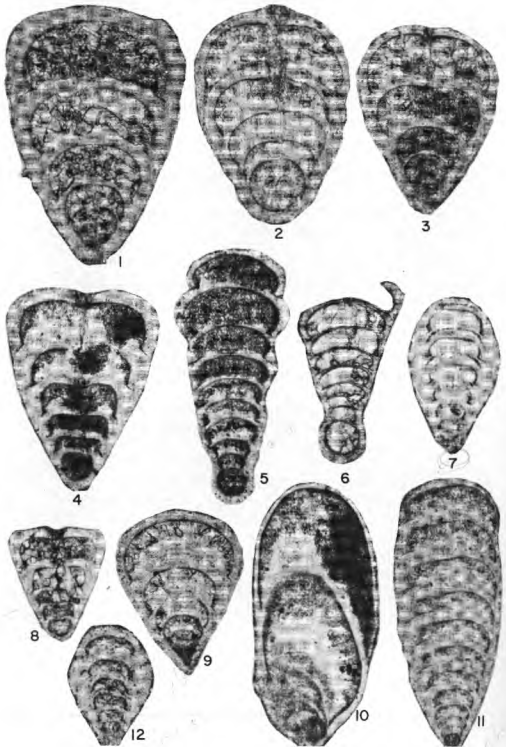
Geinitzina taurica DE CIVRIEUX & DESS.

Fig. 8 *Lower Murghabian*, Ruteh formation, same locality as fog. 1, sample no. Bz. 737 X110

Geinitzina postcarbonica SPANDEL

Fig. 9 *Lower Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 736 X110

PLATE XXXV



EXPLANATION OF PLATE XXXV
(X110)

Fig. 1 — *Langella conica* DE CIVRIEUX & DESS. *Julfian*, Nessen formation type section, sample no. Bz. 1665

Fig. 2 — *Pseudolangella fragilis* DE CIVRIEUX & DESS. *Julfian*, Nessen formation, W of Elika village, N of Kandevan pass, sample no. Bz. 883

Fig. 3,9 — *Langella çukurköyi* DE CIVRIEUX & DESS. *Julfian*, Nessen formation type section, sample no. Bz. 1665

Fig. 4,8 — *Geinitzina uralica* SULEIMANOV *Lower Murghabian*, Ruteh formation type sectionfi sample no. Bz. 736

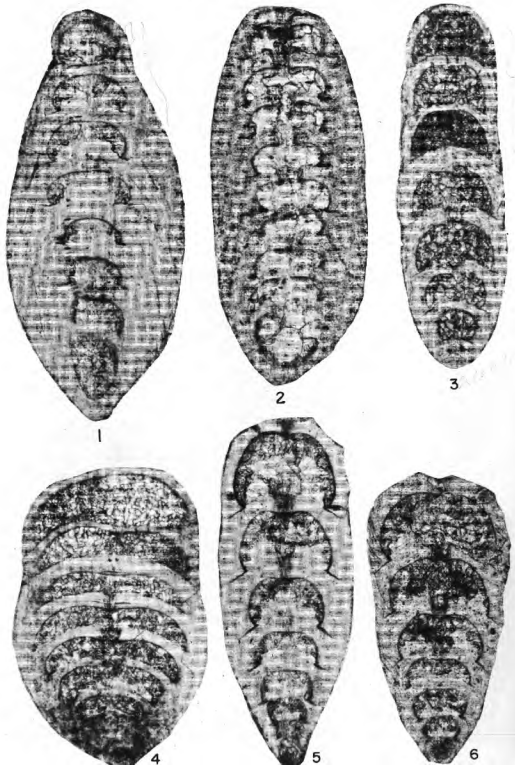
Fig. 5,6 — *Geinitzina reperta* BIKOVA *Murghabian*, Ruteh formation, same locality as fig. 1.

Fig. 7,12 — *Pachyphloia çukurköyi* DE CIVRIEUX & DESS. *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 892

Fig. 10 — *Calvezia sp. cf. C. ottomani* DE CIVRIEUX & DESS. *Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 736

Fig. 11 — *Geinitzina chapmani* SCHUBERT var. *longa* SUL. *Julfian*, Nessen formation, same locality and same sample as fig. 1

PLATE XXXVI



EXPLANATION OF PLATE XXXVI
(X90)

Pachyphloia pedicula LANGE

Fig. 1 *Julfian*, Nessen formation type section, sample no. Bz. 1665

Fig. 2 *Julfian*, Nessen formation, same locality as fig. 1, sample no. Bz. 1663

Fig. 4 *Julfian*, Nessen formation, section W of Elika valley, N of Kandevan pass, sample no. Bz. 878

Langella acantha (LANGE)

Fig. 3 *Murghabian*, Ruteh formation type section, sample no. Bz. 949

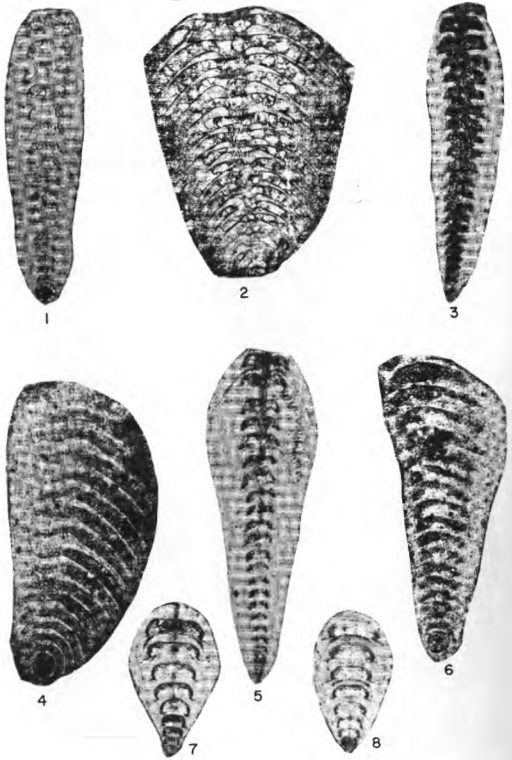
Langella venosa (LANGE)

Fig. 5 *Murghabian*, Ruteh formation, same locality as fig. 3, sample no. Bz. 703

Langella conica DE CIVRIEUX & DESS.

Fig. 6 *Upper Murghabian*, Ruteh formation, same locality as fig. 3, sample no. Bz. 712

PLATE XXXVII



EXPLANATION OF PLATE XXXVII
(X90)

Pachyphloia iranica BOZORGNIA nov. sp.

Fig. 1 *Julfian*, Nessen formation, Amol section, 24km. S of Amol, sample no. Bz. 3422 *(HOLOTYPE)*

Fig. 2 *Julfian*, Nessen formation, section W of Elika valley, N of Kandevan pass, sample no. Bz. 893

Fig. 3 *Julfian*, Nessen formation type section, sample no. Bz. 1714

Fig. 4 *Julfian*, Nessen formation, same locality as fig. 2, sample no. Bz. 895

Fig. 5 *Upper Murghabian*, Ruteh formation, Aruh section, Firuz-Kuh area, sample no. Bz. 1161

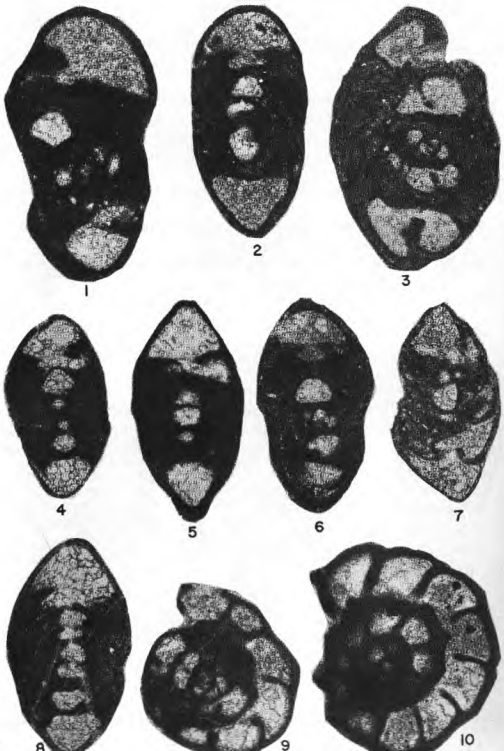
Fig. 6 *Julfian*, Nessen formation, same locality as fig. 2, sample no. Bz. 892

Pachyphloia çukurköyi DE CIVRIEUX & DESS.

Fig. 7 *Upper Murghabian*, Ruteh formation, same locality as fig. 5, sample no. Bz. 1155

Fig. 8 *Julfian*, Nessen formation, same locality as fig. 2, sample no. Bz. 895

PLATE XXXVIII



EXPLANATION OF PLATE XXXVIII
(X70)

Neonoendothyra broennimanni BOZORGNIA, nov. sp.

Fig. 1 *Upper Murghabian*, Ruteh formation, Aruh section, Firuz-Kuh area, sample no. Bz. 1049 *(HOLOTYPE)*

Fig. 3,10 *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 1017

Neoendothyra reicheli REITLINGER

Fig. 4,8-9 *Upper Murghabian*, Ruteh formation, same locality as fig. 3.

Fig. 2,5-7 *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 1031

PLATE XXXIX (29)

EXPLANATION OF PLATE XXXIX

Neoendothyra parva (LANGE)

Fig. 1-2 *Upper Murghabian*, Ruteh formation type section, sample no. Bz. 1031 X70

Fig. 5 *Upper Murghabian*, Nessen formation, Amol section, 24km. S of Amol, sample no. Bz. 3411 X70

Neoendothyra reicheli REITLINGER

Fig. 3 *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 1031 X70

Fig. 4 *Upper Murghabian*, Nessen formation, same locality as fig. 5, sample no. Bz. 3411 X70

Dagmartia chanakchiensis REITLINGER

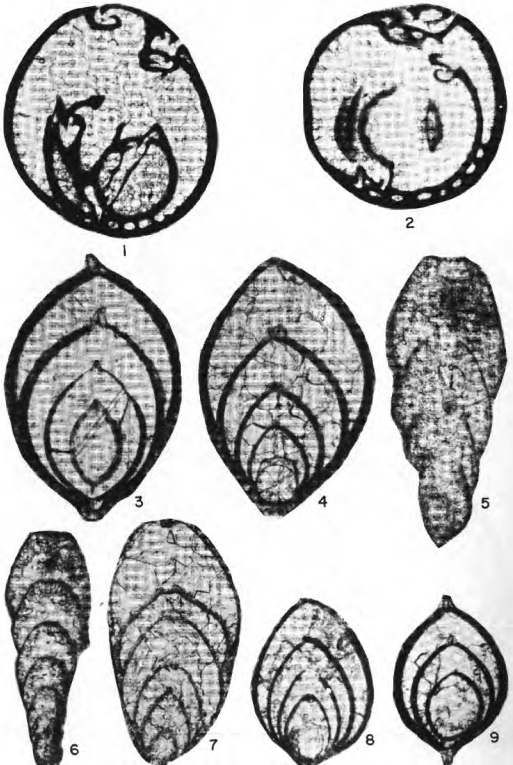
Fig. 6 *Julfian*, Nessen formation, type section, sample no. Bz. 1665 X110

Fig. 7-8 *Julfian* Nessen formation, same locality as fig. 6, sample no. Bz. 1667 X110

Paraglobivalvulina mira REITLINGER

Fig. 9-11 *Julfian*, Nessen formation, section W of Elika valley, N of Kandevan pass, sample no. Bz. 893 X30

PLATE XL (to)



EXPLANATION OF PLATE XL

Paraglobivalvulina mira REITLINGER

Fig. 1 *Julfian*, Nessen formation, section W of Elika valley N of Kandevan pass, sample no. Bz. 883 X30

Fig. 2 *Julfian*, same locality as fig. 1, sample no. Bz. 893 X30

Ichtyolaria latilimbata DE CIVRIEUX & DESS.

Fig. 3,4,8,9 *Julf an*, Nessen formation, same locality as fig. 1, sample no. Bz. 884 X110

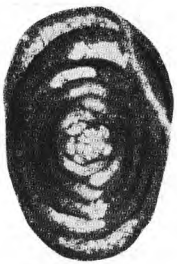
Ichtyolaria primitiva DE CIVRIEUX & DESS.

Fig. 5-6 *Julfian*, Nessen formation, same locality as fig. 1, sample no Bz. 884 X110

Ichtyolaria nessenensis BOZORGNIA, nov. sp.

Fig. 7 *Julfian*, Nessen formation type section, sample no. Bz. 1678 X110 *(HOLOTYPE)*

PLATE XLI

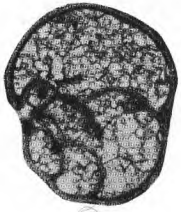


1

2

3

4



5

6

EXPLANATION OF PLATE XLI

Hemigordius sp.

Fig. 1,3 *Upper Murghabian*, Ruteh formation type section, sample no. Bz. 1017 X48

Frondina permica DE CIVRIEUX & DESS.

Fig. 2,4 *Julfian*, Nessen formation, section E of Elika valley, N of Kandevan pass, sample no. Bz. 895 X110

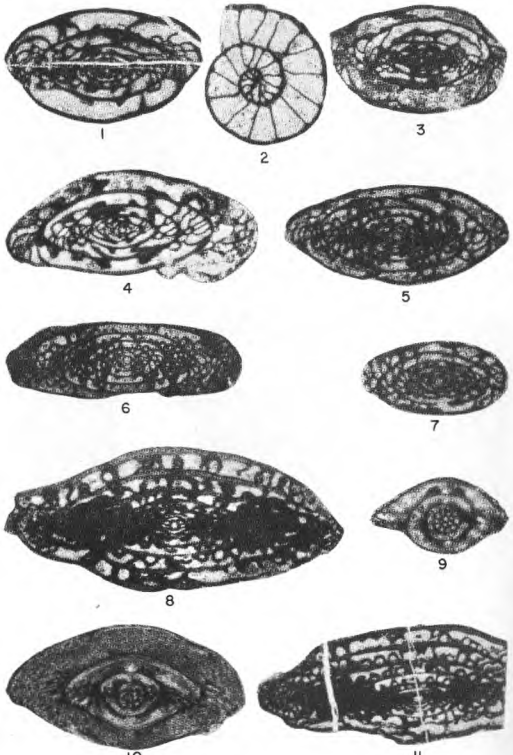
– *Globivalvulina vonderschmitti* REICHEL

Fig. 5 *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 1026 X60

Protonodosaria praecursor (R. CHERN.)

Fig. 6 *Julfian*, Nessen formation type section, sample no. Bz. 1762 X110

PLATE XLII



EXPLANATION OF PLATE XLII

Pseudoschwagerina sp.

Fig. 1,3 *Sakmarian*, Dorud formation type section, sample no. Bz. 684 X15

Fig. 2 *Sakmarian*, same locality as above, sample no. Bz. 681 X20

Triticites sp.

Fig. 4 *Sakmarian*, Dorud formation, Hassanakdar section, 70km. N of Karaj, sample no. Bz. 1376 X20

Schwagerina sp.

Fig. 5 *Sakmarian*, Dorud formation, same locality as fig. 1, sample no. Bz. 960 X15

Fig. 6,7 *Sakmarian*, Dorud formation, Khoshyeilagh section, N of Shahrud, sample no. Me. 674 X15

Chusenella sp.

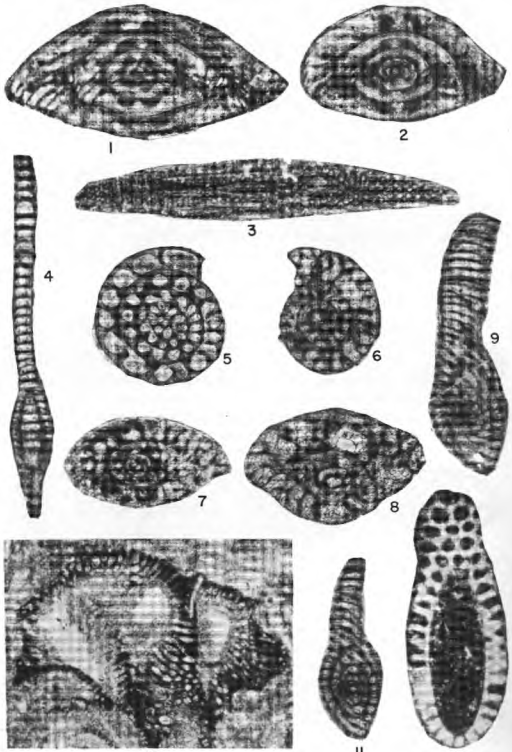
Fig. 8 *Lower Murghabian*, Ruteh formation, section of Bibi-shahrbanu, S of Tehran, sample no. Bz. 443 X20

Fig. 11 *Upper Murghabian*, Ruteh formation type section, sample no. Bz. 720 X15

Schubertella sp.

Fig. 9,10 *Lower Murghabian*, Ruteh formation, same locality as fig. 11, sample no. Bz. 708 X50

PLATE XLIII



EXPLANATION OF PLATE XLIII

Schubertella sp.
Fig. 1-2 *Lower Murghabian*, Ruteh formation type section, sample no. Bz. 710 X50

Minojapanella sp.
Fig. 3 *Lower Murghabian*, same locality as fig. 1, sample no. Bz. 735 X50

Reichelina sp.
Fig. 4,9,11 *Julfian*, Nessen formation type section, N of Kandevan pass, sample no. Bz. 1665 X50

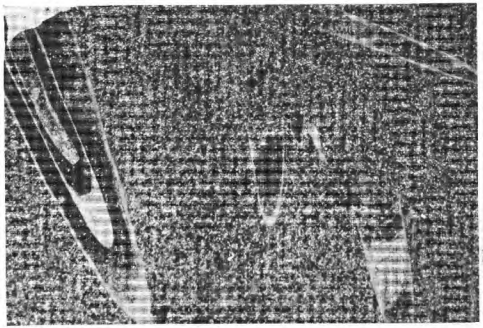
Neoschwagerina sp.
Fig. 5 *Upper Murghabian*, Ruteh formation, same locality as fig. 1, sample no. Bz. 736 X50

Paleofusulina? sp.
Fig. 6-8 *Julfian*, Nessen formation, section W of Elika valley, N of Kandevan pass, sample no. Bz. 877 X50

Vermiporella niponica
Fig. 10 *Upper Murghabian*, Ruteh formation, Aruh section, Firuz-Kuh area, sample no. Bz. 1076 X45

Mizzia sp.
Fig. 12 *Julfian*, Nessen formation, same locality as fig, 4, sample no. Bz. 1760 X25

PLATE XLIV (33)



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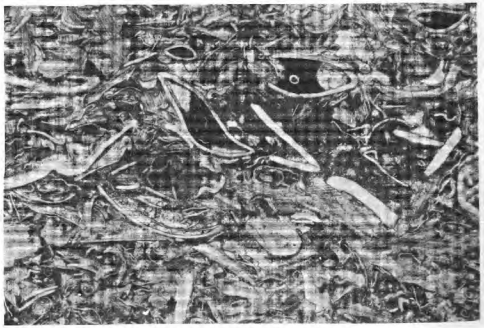


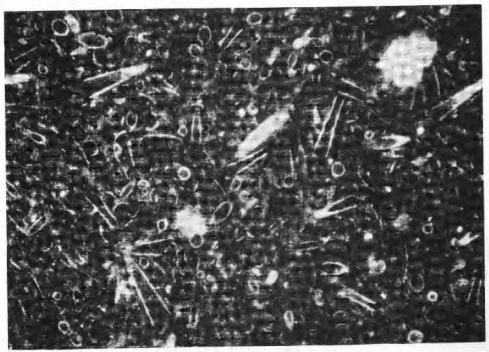
2

EXPLANATION OF PLATE XLIV

Fig. 1 Siltstone with *Biconulites* sp.
Middle Cambrian, Mila formation, Shahmirzad section, sample no. Bz. 2934 X15

Fig. 2 Biomicrite with trilobite-fragments
Middle Cambrian, Mila formation, Hassanakdar section, N of Karaj, sample no. Bz. 1574 X15

PLATE XLV (ED)



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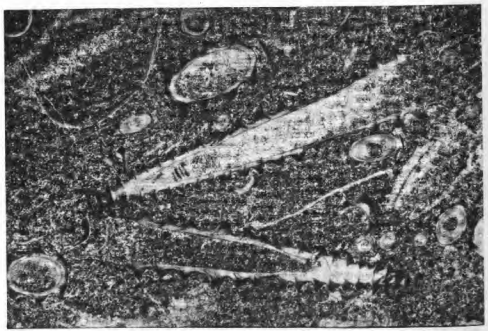

2

EXPLANATION OF PLATE XLV

Fig. 1 Fossiliferous micrite with *Eopteropoda (Stylioliná) Upper Givetian? - Lower Frasnian,* Khoshyeilagh formation type section, NE of Shahrud, sample no. Me. 2089 X25

Fig. 2 Fossiliferous micrite with *Tentaculites* sp. *Lower Frasnian,* same locality as above, sample no. Me. 1870 X15